BIOLOGICAL OPINION

AGENCY:	Marine Mammal Division, Office of Protected Species, National Marine Fisheries Service (NMFS)
ACTIVITY:	Interim final rule for the continued authorization of the United States tuna purse seine fishery in the eastern tropical Pacific Oceân under the Marine Mammal Protection Act and the Tuna Conventions Act as revised by the International Dolphin Conservation Program Act.
CONSULTATION CONDUCTED BY:	Endangered Species Division, Office of Protected Resources, Southwest Region, NMFS
DATE ISSUED:	12/8/99 Don Knowles

This document represents the NMFS' biological opinion (Opinion) based on our review of the interim final rule to continue authorization of the U.S. tuna purse seine fishery in the eastern tropical Pacific Ocean under the Marine Mammal Protection Act, as revised by the International Dolphin Conservation Program Act, and its effects on loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) sea turtles in accordance with section 7 of the Endangered Species Act of 1973 as amended. On November 18, 1999, the Marine Mammal Division, Office of Protected Resources, NMFS, requested initiation of formal section 7 consultation on the proposed interim final rule with the Endangered Species Division, Office of Protected Resources, NMFS. The Endangered Species Division received this request on November 18, 1999.

This Opinion is based on information provided in the October 1999 draft environmental assessment of the proposed rule to implement the International Dolphin Conservation Program Act (P.L. 105-42) (NMFS, 1999), sea turtle recovery plans, past and current research, and biological opinions for other relevant fisheries. A complete administrative record of this consultation is on file at the NMFS, Southwest Regional Office, Long Beach, California.

I. Consultation History

Purse seine tuna fishing in the eastern tropical Pacific Ocean (ETP) involves setting on pure schools of tuna, tuna associated with floating objects, and tuna associated with marine mammals. In the late 1950s fishermen became aware of the close association between schools of dolphins and large yellowfin tuna (over 25 kilograms), and began to place their nets around schools of dolphins, which are relatively easy to locate, in order to catch the associated tuna. Studies began in 1971 to estimate the incidental dolphin mortality caused by United States (U.S.) and foreign yellowfin tuna purse seine vessels in the ETP. Around that time, the ETP fishery was dominated by U.S. vessels and the level of annual dolphin mortality was estimated to be around 250,000 dolphins. With enactment of the Marine Mammal Protection Act (MMPA) in 1972, incidental mortality from fishing by the U.S. domestic fleet began to decline, but participation in the fishery by foreign vessels began to increase. Although the U.S. industry was instrumental in developing gear for reducing mortality and adopting procedures for releasing animals, foreign vessels were not subject to the requirements of the MMPA, and dolphin mortality associated with fishing by the foreign fleet began to rise as foreign participation grew in the ETP. For example, in 1971, the U.S. had 124 purse seine vessels which were responsible for the mortality of over 246,000 dolphins. During this same year, the foreign fleet consisted of 48 vessels and killed nearly 16,000 dolphins. In 1987, the U.S. fleet had 34 vessels, which killed almost 14,000 dolphins, while the foreign fleet consisted of 126 vessels, which were responsible for the mortality of over 85,000 dolphins.

In 1988, Congress again amended the MMPA in response to continued high dolphin mortality caused by foreign vessels fishing in the ETP. With regard to the U.S. fleet, the 1988 amendments specified that U.S. tuna fishermen setting on marine mammals must complete the process of backdown to remove dolphins from the net no later than 30 minutes after sundown. In addition, all U.S. tuna boats were required to carry an observer on every fishing trip, and a system of performance standards designed to maintain the diligence and proficiency of tuna purse seine skippers was to be developed and implemented by 1990. The 1988 amendments also provided more specific direction as to determining the comparability of foreign dolphin protection programs. Under the amendments, in order to be found comparable to the U.S. program, a foreign program was required to include: 1) by the beginning of the 1990 fishing season, prohibitions on conducting sundown sets and such other activities as were applicable to U.S. vessels; 2) monitoring by observers; and 3) observer coverage equivalent to that for U.S. vessels.

In 1990, Congress passed the Dolphin Protection Consumer Information Act (DPCIA). The DPCIA required that tuna labeled as "dolphin-safe" meet certain dolphin-safe criteria: only tuna which was harvested by ETP purse seiners in which no dolphins were intentionally encircled at any time on the entire trip could be labeled as being dolphin-safe. The DPCIA did not actually require dolphin-safe labeling, but during the same time period, U.S. tuna canners instituted a voluntary dolphin-safe tuna campaign under which they purchased only dolphin-safe tuna for the U.S. market.

The International Dolphin Conservation Act (IDCA) was passed in 1992. The goal of the IDCA was to establish an international moratorium on the practice of harvesting tuna through the use of purse seine nets deployed on or to encircle dolphins or other marine mammals. The United States, however, was unsuccessful in convincing any other nation to commit to the moratorium. In 1992 only seven U.S. vessels were active in the ETP purse seine fishery because most of the fleet had transferred to the western Pacific fishing grounds. Nevertheless, the IDCA established limits on dolphin mortality by U.S. fishing vessels and required that the number of dolphins killed or seriously injured decrease from one year to the next. The IDCA also made it unlawful for any person to sell other than dolphin-safe tuna in the U.S. after June 1, 1994. Foreign participation in the ETP fishery continued to increase, however, and mortality was monitored and limited under a voluntary international dolphin conservation program organized by the Inter-American Tropical Tuna Commission (IATTC).

In 1992, nations with tuna fishing interests in the ETP, including the U.S., adopted a non-binding multilateral program known as the La Jolla Agreement. The La Jolla Agreement established a dolphin mortality reduction schedule providing for progressive reductions in annual dolphin mortalities, with a goal of eliminating dolphin mortality in the fishery. By resolution, the IATTC, to which the U.S. is a party, adopted this agreement. Mortality of dolphins was managed under the voluntary International Dolphin Conservation Program (IDCP). The success of the La Jolla Agreement led the U.S. and other nations that participated in the agreement to strengthen and enhance the program by developing a legally binding, formal international agreement, the Panama Declaration. In October 1995, the governments of Belize, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Panama, Spain, the United States, Vanuatu, and Venezuela signed the Panama Declaration. This international agreement established conservative species/stock-specific annual dolphin mortality limits (DMLs) and represented an important step toward reducing bycatch in ETP tuna fisheries and implementing sound ecosystem management. The Panama Declaration anticipated that the U.S. would change the provisions of the MMPA to allow the U.S. to import yellowfin tuna from nations that are participating in, and are in compliance with, the IDCP.

The International Dolphin Conservation Program Act (IDCPA) was signed into law on August 15, 1997 (Public Law (P.L.) 105-42), in order to recognize and implement the IDCP and to address related issues. The IDCPA provides the basis for the importation of yellowfin tuna that would otherwise be under embargo because it was harvested by encircling dolphins, as long as the harvesting nation provides documentary evidence of its participation in the IDCP and its membership or application for membership (completed within 6 months) in the IATTC ("affirmative finding"). The IDCPA also allows U.S. fishing vessels to participate in the ETP yellowfin tuna fishery on dolphin. In addition, under the IDCPA, the definition of dolphin-safe tuna would change, if certain findings based upon mandated research are made. Specifically, tuna harvested in a set with no observed dolphin mortality would be considered dolphin-safe, regardless of whether the set intentionally encircled dolphins to catch tuna. The Agreement on the IDCP became effective on February 15, 1999 when, as required, four countries, the United States, Panama, Ecuador, and Mexico deposited their instruments of either ratification, acceptance, or adherence with the Depositary. On March 3, 1999, the Secretary of State provided the required certification to Congress that the Agreement on the IDCP was adopted and was in force. The IDCPA became effective on this date. A time line of the history of the tuna/dolphin program is contained in Appendix 1.

1990 Consultation

The ETP tuna purse seine fishery incidentally takes the following species of sea turtles: loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*) and olive ridley turtle (*Lepidochelys olivacea*). On April 25, 1989, the Center for Marine Conservation requested that NMFS use its observer program to collect information on the incidental take of sea turtles in the ETP. As a result, NMFS prepared an issue paper (NMFS, 1990a) to: (1) review the available information on sea turtles in the ETP; (2) review data collected in 1975 in the incidental take of sea turtles in purse seine fishery; (3) evaluate NMFS' responsibility under the ESA for managing the take to conserve the species; (4) identify potential impacts of the problem on the tuna industry; (5) determine the impact of adding additional requirements to the observer program (collecting sea turtle data in addition to marine mammal data); and (6) recommend an appropriate course of action.

NMFS prepared an Opinion on July 6, 1990, to evaluate the effects of the ETP tuna purse seine fishery on sea turtle populations (NMFS, 1990b). NMFS concluded in this Opinion that the level of sea turtle take by the international tuna purse seine fishery in the ETP was extremely small compared to the level of effects these sea turtle populations experience from other sources. For instance, effects to sea turtles associated with habitat loss, harvest for meat, egg harvest and incidental take in trawl and gillnet fisheries exceeded the estimated takes by the ETP purse seine fishery. Based on those analyses, NMFS concluded that because the effects imposed by the ETP purse seine fishery did not significantly contribute to general population declines, U.S. ETP tuna purse seine fishing operations would not likely jeopardize the continued existence of the sea turtle species. Based on past take levels and anticipated fishing levels in the ETP, NMFS anticipated the annual incidental take, by injury or mortality, of no more than 180 turtles by the U.S. fleet. Of these turtles, no more than 20 comatose animals could be taken each year (10 olive ridleys, 3 greens, 3 loggerheads, 2 hawksbills, and 2 leatherbacks), and no more than 12 mortalities were allowed each year (8 olive ridleys, 1 green, 1 loggerhead, 1 hawksbill, and 1 leatherback).

Listed Cetaceans

The following endangered whales occur in the ETP: sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), sei whale (*B. borealis*), fin whale (*B. physalus*), humpback whale (*Megaptera novaeangliae*), and the southern right whale (*Eubalaena australis*). With the exception of the sperm whale (suborder Odontoceti), all of these whales are in the suborder Mysticeti (i.e., baleen whales). Two other non-listed baleen whales also occur in the ETP: minke whale (*Balaenoptera acutorostrata*) and Bryde's whale (*Baleaenoptera edeni*).

Between 1979 to 1990, out of 21,554 sets made by the U.S. tuna purse seine fishery (large vessels only (>400 st)) in the ETP, only 5 sets resulted in the accidental encirclement (net is not "pursed" yet) of a large whale (one was a Bryde's and the others were unidentified whales) (R.

Rasmussen, NMFS, personal communication, 1999). Out of these five sets, only 2 large whales were captured (net is "pursed") and none were reported as a mortality. Based on these data, the baleen whale "encirclement rate" in the U.S. ETP tuna purse seine fishery (large vessels) is estimated to be 0.000231 whales per set. In other words, for every 10,000 sets, approximately 2 large whales may be accidentally encircled in the U.S. ETP tuna purse seine fishery--the likelihood that a large whale may be captured is even lower. The data indicate that encircled and captured whales escape the net, or are released from the net circle, uninjured.

In 1997, one "unidentified baleen whale" was reported accidently killed in the ETP tuna purse seine fishery (IATTC, 1999). No information is available to determine whether the whale killed in 1997 was a listed species. Thus, because both listed and unlisted baleen whales occur in the ETP, it is not possible to determine whether the whale reported killed was listed under the ESA. NMFS has no other observer reports of baleen whales accidentally killed in the ETP tuna purse seine fishery.

Since 1993, there has been nearly 100 percent observer coverage in the entire ETP tuna purse seine fishery (large (>400 st) vessels). During that period, over 100,000 sets were observed and one baleen whale was accidentally captured and killed. Based on these observed sets, the chances that a baleen whale will be killed in a purse seine net are less than 1 whale per 100,000 sets or 0.00001 whales per set. Thus, even if the whale killed in the fishery in 1997 had been a listed baleen whale, NMFS believes that the probability that a baleen whale (listed or non-listed) will be incidentally killed in the future is extremely unlikely.

Based on the extremely low likelihood that a whale will be encircled or captured, and the even lower likelihood that a whale may be accidentally killed, NMFS does not anticipate the encirclement, capture, or accidental death of a whale to occur in the U.S. ETP tuna purse seine fishery. Therefore, NMFS has determined that the proposed action is not likely to adversely affect listed whales.

II. Proposed Action

NMFS published a proposed rule to implement provisions of the IDCPA on June 14, 1999 (64 FR 31806). Some commenters on the proposed rule were concerned that the duration of the public comment period (30 days) was too short. As a result, NMFS is publishing an interim final rule (with a 90-day comment period), as opposed to a final rule, so the agency can both continue to accept additional public comments and meet its programmatic and mission goals in a timely manner. The interim final rule will become effective 30 days after its publication in the Federal Register. The proposed action is the publication and implementation of this interim final rule. NMFS will publish a final rule to implement the IDCPA after it reviews the public comments it receives on the interim final rule. Since NMFS does not know exactly when it will publish the final rule, NMFS will assume the duration of the interim final rule to be indefinite for the purposes of analysis in this biological opinion. The interim final rule will:

(i) allow U.S. fishing vessels to fish for tuna in the ETP on equivalent terms with the flag vessels of other IDCP signatory nations--vessels over 400 st carrying capacity with a valid permit would be allowed to deploy a net on or encircle dolphins in the course of tuna fishing in the ETP;
(ii) implements a change in the definition of "dolphin-safe" tuna harvested by large (>400 st) vessels in the ETP, provided that the initial and final findings do not conclude that chase and encirclement is having a significant adverse impact on depleted dolphin stocks;
(iii) exclude yellowfin tuna harvested by vessels of a nation which meets certain requirements including compliance with the IDCP, and IATTC application and membership requirements specified in the IDCPA, from the prohibition on the sale, purchase, offer for sale, transport or shipment of tuna products in the United States which is not dolphin-safe (i.e., lift embargoes of such compliant nations);
(iv) allow U.S. citizens employed on a purse seine vessel of another IDCP signatory nation with an affirmative finding to take marine mammals incidentally during fishing operations;
(v) establish a domestic tracking and verification program.

United States vessels have not been allowed to set on dolphin schools since 1994. The IDCPA and the interim final rule allow U.S. vessels to set their nets on schools of dolphins. Specifically, a U.S. purse seine fishing vessel over 400 short tons (st) carrying capacity with a valid permit would be allowed to deploy a net on or encircle dolphins in the course of tuna fishing in the ETP. Any such vessel would have to comply with all requirements regarding gear and fishing procedures under the interim final rule. Gear requirements include a dolphin safety panel with markers, hand holds and corkline hangings, a minimum of three speedboats, a raft, at least 2 face masks and snorkel, or view box, and lights capable of producing a minimum output for use in darkness. The interim final rule also has marine mammal release requirements which include backdown procedures and a prohibition on sundown sets.

<u>Description of the Fishery</u>

The target species sought by the ETP tuna purse seine fishery are yellowfin and skipjack tuna, although bigeye has also become an important component in recent years. Tuna purse seine vessels vary in size from 45 to 1700 st carrying capacity and range from forty year-old baitboat conversions to brand new, sleek, super-seiners. Seven U.S. vessels and over 98 foreign vessels with carrying capacity greater than 400 st are currently operating or have recently operated in the ETP. Since 1971, the number of large U.S. purse seine vessels fishing for tuna in the ETP has been reduced from over 155 to an average of 6 over the past five years. Most of the vessels that used to fish in the ETP have either re-flagged or are now active in the western Pacific, where a treaty with the south Pacific islands (the South Pacific Regional Tuna Treaty, signed in 1988) provides the fleet with access to richer fishing grounds. This trend is not likely to change, for purely economic reasons. Western Pacific tuna fishermen catch more and larger tuna per set compared to ETP tuna fishermen and thus make fewer and shorter trips.

The IATTC operates under the authority and direction of a convention originally entered into by Costa Rica and the United States. The convention, which came into force in 1950, is open to adherence by other governments whose nationals fish for tropical tunas and tuna-like species in the ETP. Current member nations of the IATTC include the United States, Costa Rica, Panama, Ecuador, Japan, France, Nicaragua, Vanuatu, Venezuela, El Salvador, and Mexico. Individual nations implement the recommendations made by the IATTC each year. Historically, the IATTC only set quotas for yellowfin tuna. More recently, with the advent of the IDCPA, the Agreement on the IDCP, and the apparent resolution of issues regarding tuna/dolphin management, the IATTC is moving rapidly into other fishery management issues, such as establishing quotas for bigeye tuna, restricting sets on floating objects, or closing certain fishing areas to reduce the catch of juvenile tuna. Several work groups will meet early in the year 2000 to discuss the extension of the resolution limiting current purse seine fleet capacity, measures to reduce bycatch and discards, and future bigeye quotas. Any changes in fishing regulations as a result of the workshops shall be reviewed and consulted on, as necessary, when they occur.

The United States strongly supports fleet capacity control, and in 1999 agreed to an IATTC resolution that set a total ETP purse seine fleet capacity limit, including a limit on U.S. purse seine fleet capacity of 8,969 mt carrying capacity for 1999. The U.S. limit was based on the capacity of U.S. vessels active in the ETP in recent years. In addition, U.S. purse seine vessels based in the western Pacific were allowed to make one trip into the ETP without counting against the U.S. fleet limit.

No U.S. vessels from the western Pacific fished under the terms of the resolution to date in 1999. This is probably because fishing conditions in the western Pacific were favorable. The fact that a U.S. vessel fishing in the ETP would also have had to carry an observer may also have contributed to a decision not to fish in the ETP. While the IATTC and the Forum Fisheries Agency (which administers the South Pacific Tuna Treaty on behalf of the Pacific island states) have discussed the possibility of accepting each other's observers for the purposes of their respective programs, no firm agreement is yet in place. In any event, unless there is a change in the economics of the fisheries, such that fishing in the ETP would be more advantageous for the U.S. fleet, there is no reason to expect that U.S. vessels will significantly expand their activity in the ETP. The cost or difficulty of arranging for observers is not expected to be a decisive factor in deciding where to fish. The U.S. continues to support IATTC efforts to establish a purse seine fleet capacity limit that would limit overall U.S. fleet capacity while providing opportunity for western Pacific vessels to fish in a limited manner in the ETP in any given year.

Purse seine vessels use a long net to encircle the target species. During deployment of gear, the net forms a circular wall of webbing around the school. The net must be deep enough to reduce the likelihood of fish escaping underneath, and the encircling must be done rapidly enough to prevent the fish from escaping before the bottom is secured shut. Depending on the size of vessels, nets generally vary from 1/4 mile to one mile in length, and from 300 to 700 feet in depth.

For reasons that are still not clear, yellowfin tuna over 55 pounds are often found in association with schools of dolphins in the ETP. Tuna fishermen have taken advantage of the association between yellowfin tuna and dolphins by using the more easily detected dolphin schools to help find fish. Dolphin sets catch relatively large yellowfin tuna, some or (rarely) all of the associated tuna, and very little else. Log sets (sets on tuna schools associated with floating logs or fish aggregating devices (FADs)) tend to catch small, pre-reproductive yellowfin tuna or skipjack tuna (or a mixture of both tuna), together with a wide variety and large quantity of other biota, including sea turtles, sharks, billfish, other large and small sportfish, and a variety of other small noncommercial tunas. School sets (sets on tuna schools not associated with either floating objects or with dolphins) tend to catch free-swimming schools of moderately small yellowfin tuna, or mixed schools of yellowfin and skipjack tuna, and little else. Dolphin sets traditionally have been preferred by tuna fishermen because the associated yellowfin tuna are abundant, large, relatively easy to locate and capture, not associated with unwanted fish, and generally have been more valuable per pound than the smaller school or log associated tuna (Edwards and Perkins, 1998).

IATTC data indicate that fishing on floating objects in the ETP is now more common than fishing on schools. The number of school sets per year has dropped from nearly 8,000 sets in 1988 to about 5,300 sets in 1997, while the number of floating object sets has risen from less than 3,000 sets in 1988 to just under 6,000 sets in 1997. Most of this increase reflects the shift to fishing on FADs, which now account for 80-90 percent of all sets on floating objects. Fishing on floating objects results in higher levels of discards of small tuna, with discards of almost 8 mt per set in 1995-97, versus discards of less than 0.4 mt per set in school sets in the same period and virtually no discards of tuna in dolphin sets (IATTC, 1999).

IATTC (1999) data indicate that sea turtles have been captured and killed by the entire (U.S. and foreign) ETP purse seine fleet in all three types of sets; however, FAD sets (or log sets) had the highest rate of turtle mortality (average 25.6 turtles per 1,000 sets), followed by school sets (average 9.8 turtles killed per 1,000 sets) and then dolphin sets (average 5.8 turtles killed per 1,000 sets) within the entire ETP purse seine fishery. From 1990-97, the U.S. fleet (large vessels only) killed on average 1 turtle per 1,000 school sets (3 sea turtles/2861 school sets), 0.9 turtles per 1,000 floating object sets (3 sea turtles/3396 floating object sets), and 0.4 turtles per dolphin sets (1 sea turtle/2335 dolphin sets). On average, the U.S. fleet takes (includes all turtles captured and released unharmed, injured, or killed) an average of 75 turtles per 1,000 school sets and 234 sea turtles per 1,000 floating object sets. When the fleet fished on dolphin, up until 1994, they took an average of 37 sea turtles per 1,000 dolphin sets (see Table 7).

Description of the Action Area

The ETP refers to an area of the Pacific Ocean that covers approximately 19 million square miles and is bounded by 40°N latitude, 40°S latitude, 160°W longitude and the coastlines of North, Central and South America (50 CFR § 216.3). The ETP serves as habitat for many marine species, including yellowfin, skipjack and bigeye tunas and a variety of dolphins. In addition, it appears to be the only area in the world where tuna and dolphins are frequently found in close association with one another. In fact, the ETP is the only body of water in which purse seine fishing on dolphins is known to commonly occur. The tuna-dolphin association primarily occurs in a subregion of the ETP, a triangular region roughly the size of the continental U.S. (about 10 million square kilometers), extending from the tip of Baja California (about 20°N) southward to Peru (about 20°S) and seaward to about 140°W.

III. Status of Affected Species/Critical Habitat

Sea turtles are the only species listed under the Endangered Species Act which may be adversely affected by the proposed action. The following is a list of the sea turtle species found in the ETP and their current legal status:

Sea Turtle Species	Status
Loggerhead turtle	Threatened
Leatherback turtle	Endangered
Green turtle	Threatened/endangered
Hawksbill turtle	Endangered
Olive Ridley turtle	Threatened/endangered

All stocks/populations of sea turtles incidentally taken in the U.S. tuna purse seine fishery are in decline. These declines are further discussed in section B. Impacts to sea turtles in the Pacific Ocean are primarily due to the composite effect of human activities which include the legal harvest and illegal poaching of adults, immatures, and eggs; incidental capture in commercial fisheries; and loss and degradation of nesting and foraging habitat as a result of coastal development. Increased environmental contaminants (e.g. sewage, industrial discharge), which adversely impact nearshore ecosystems that turtles depend on for food and shelter, including sea grass and coral reef communities, also contribute to the overall decline. More information on the status of these species along with an assessment of overall impacts are found in this section as well as the Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-e) and are reviewed extensively in Eckert (1993).

Critical habitat for the loggerhead, leatherback, green, hawksbill, and olive ridley turtles has not been designated or proposed within the ETP.

A. Status of the Species

The following is a synopsis of the current state of knowledge on the life history, distribution, and population trends of sea turtle species that have been reported incidentally taken in the U.S. tuna purse seine fishery in the ETP or which may be found in the action area.

Loggerhead Turtle
The loggerhead turtle is listed as threatened throughout its range. It is a cosmopolitan species

found in temperate and subtropical waters. Major nesting grounds are generally located in warm temperate and subtropical regions, generally north of 25°N or south of 25°S latitude in the Pacific Ocean. Clutch size averages between around 110 and 130 eggs, and one to six clutches (average two in Japan) of eggs are deposited during the nesting season (Dodd, 1988). Loggerheads undertake long reproductive migrations between their nesting sites and foraging areas; for example, in Queensland, the average remigration frequency is 3.75 years (range 1-8). However, their distribution in foraging areas is not well known for any population. Juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae, while adult loggerheads are generally found feeding on benthic invertebrates in hard bottom habitats (Dodd, 1988, *in* Eckert, 1993). A study off the coast of Baja California, Mexico indicated that the presence of loggerheads reflected a migration pattern probably related to their feeding habits (Cruz, *et al*., 1991, *in* Eckert, 1993). More recent satellite telemetry data on pelagic juvenile loggerhead movement after posthooking in the Hawaiian longline fishery indicates the tracks were below 40°N latitude. All nine sea turtles tracked during 1997 and 1998 traveled westward along two convergent oceanic fronts, against prevailing currents and associated with fronts characterized by sea surface temperature, surface chlorophyll and a geostrophic current. Evidence for countercurrent movement of pelagic loggerheads in the north Pacific Ocean was based on satellite telemetry together with satellite remotely sensed data on sea surface characteristics (Polovina *et al*., (in press)).

There are no reported loggerhead nesting sites in the eastern or central Pacific; however, large aggregations of mainly juveniles and subadults, numbering in the thousands, occur at what is likely to be a large foraging area off the west coast of Baja California Sur, Mexico (Pitman, 1990). Genetic studies have shown these animals originate from Japanese nesting stock (Bowen *et al*., 1995).

In the western Pacific the only major nesting beaches are in the southern part of Japan (Dodd, 1988). Balazs and Wetherall (1991) speculated that 2,000 to 3,000 female loggerheads may nest annually in all of Japan; however, more recent data suggest that only approximately 1,000 female loggerhead turtles may nest there (Bolten *et al*. 1996). Nesting of loggerheads may also occur along the south China Sea, but it is a rare occurrence (Marquez, 1990, *in* Eckert, 1993). In the south Pacific, Limpus (1982) reported an estimated 3,000 loggerheads nesting annually in Queensland, Australia. Long-term trend data from Queensland indicate a decline in nesting which is corroborated by studies of breeding females at adjacent feeding grounds (Limpus and Reimer, 1994). By 1997, the number of females nesting annually in Queensland was thought to be as low as 300 (1998 Draft Recovery Plan for Marine Turtles in Australia). Otherwise, quantitative information is lacking on whether populations are increasing or declining in the south Pacific area. Genetic studies of loggerhead turtles taken in the now defunct North Pacific high-seas driftnet fisheries indicate that these turtles originated from the Japanese nesting stock. More recent information from the U.S. Hawaii longline fishery indicate that 95 percent of the loggerhead turtles caught in this fishery also originated from the Japanese nesting stock (Dutton, *et al.* (in press)).

There are no records of loggerheads nesting in the Hawaiian islands and only four records of juveniles have been documented in the area (NMFS and USFWS, 1998a). However, trans-Pacific migrations occur as evidenced by the incidental capture in the U.S. Hawaii-based longline fishery, tag returns, satellite telemetry studies, and by the presence of large numbers of juveniles off Baja California Sur.

While at-sea sightings of loggerheads are relatively common in the western Pacific, reports from the eastern Pacific are rare. Sightings off Hawaii have been reported, and evidence that loggerheads inhabit the high seas of the Pacific is provided by data indicating that the species was commonly caught in north Pacific driftnets (Eckert, 1993) and in the Hawaiian longline fishery in the high seas just north of the Hawaiian EEZ.

Threats to loggerheads in the Pacific include mortalities associated with egg and turtle harvest, commercial fisheries, vessel collisions, ingestion and entanglement in debris and fishing gear, and loss of habitat due to human presence (NMFS and USFWS, 1998a).

<u>Leatherback Turtle</u>
The leatherback turtle is listed as endangered throughout its global range. Increases in the number of nesting females have been noted at some sites, but these are far outweighed by local extinctions, especially of island populations, and the demise of once large populations, such as in Malaysia and Mexico. The most recent estimate of the world population of leatherbacks is currently only 25,000 to 42,000 turtles (Spotila *et al.*, 1996).

Leatherback turtles are the most widely distributed of all sea turtles and have been reported circumglobally from 71°N to 42°S latitude in the Pacific and in all other major oceans (NMFS and USFWS, 1998b). It is the largest of the marine turtles, and forages widely in temperate waters. Similar to the olive ridley turtle, they lead a completely pelagic existence except during nesting, when females return to beaches to lay eggs. On the Pacific coast of Mexico, females lay 1-11 clutches per annum, with clutch size averaging 64 yolked eggs (each clutch contains a complement of yolkless eggs, sometimes comprising as much as 50 percent of total clutch size, a unique phenomenon among sea turtles). Clutch size in Terengganu, Malaysia, and in Pacific Australia averages around 85-95 yolked eggs and 83 yolked eggs, respectively (Eckert, 1993). Females are believed to migrate long distances between foraging and breeding grounds, at intervals of typically two or three years (NMFS and USFWS, 1998b).

In the Pacific, leatherbacks do not nest on beaches under U.S. jurisdiction. However, leatherback turtles are commonly observed by fishermen in Hawaiian offshore waters, generally beyond the 100-fathom isopleth. Two areas where sightings often take place are off the north coast of Oahu and the west coast of the island of Hawaii (Hawaiian Sea Turtle Recovery Team, 1992). There is strong evidence to suggest that the pelagic zone surrounding the Hawaiian Islands constitutes regularly used foraging habitat and migratory pathways for this species.

Leatherbacks are declining at all major Pacific basin nesting beaches (NMFS and USFWS, 1998b). Major leatherback nesting areas are found along the Pacific coast of Mexico and Costa Rica, and along the coasts of Indonesia and the Solomon Islands in the western Pacific.

Leatherback populations have declined dramatically in the Pacific in the last two decades (Spotila *et al*., 1996). In Las Baulas, Costa Rica the number of nesting leatherbacks has declined from 1500 in 1988-1989 to 193 in 1993-1994 (Steyermark *et al*., 1996). The decline of leatherback is equally as dramatic off Mexico. According to reports from the late 1970's and early 1980's, three beaches located on the Pacific coast of Mexico sustained a large portion of all global nesting of leatherbacks, perhaps even one-half. Monitoring of the nesting assemblage at Mexiquillo, Mexico has been continuous since 1983-84. According to Sarti *et al.* (1996), nesting has declined at this location at an annual rate of 22 percent for the last 12 years. In fact, the number of nesting female leatherbacks here has been reduced from an estimated 2,000 turtles in 1980 to only 14 in 1993-1994. During the 1995-96 season, fewer than 1,000 nesting females were estimated for the entire Pacific coast of Mexico (Sarti *et al*., 1996), and fewer than 300 were documented during the 1996-97 season (Sarti *et al*, 1997).

The collapse of these nesting populations was precipitated by a tremendous overharvest of eggs coupled with incidental mortality from fishing (Eckert and Sarti, 1997), specifically the advent of the high seas driftnet fishery in the 1980's (Sarti *et al*., 1996). Eckert and Sarti (1997) speculate that the swordfish gillnet fisheries in Peru and Chile have also contributed to the decline of the leatherback in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico occurred at the same time that effort doubled in the Chilean driftnet fishery.

The decline of leatherbacks is equally severe for the Terengganu, Malaysia population, with current nestings representing 1 percent of the levels recorded in the 1950s. The nesting population at this location has declined from 3,103 females estimated nesting annually in 1968 to 2 nesting females in 1994 (Chan and Liew, 1996). Years of excessive egg harvest, egg poaching, the direct harvest of adults in this area as well as incidental capture in various fisheries in territorial and international waters have impacted the Malaysia population of leatherbacks. The nesting populations in Irian Jaya and New Guinea are also reported to be declining.

Because leatherbacks have the most extensive range of any living reptile, studies of their abundance and pelagic distribution are difficult. Recent satellite telemetry studies indicate that adult leatherbacks follow bathymetric contours over their long pelagic migrations and typically feed on cnidarians (jellyfish and siphonophores) and tunicates. The eastern Pacific region has been shown to be a critical migratory route for nesting females from Mexiquillo Beach, Mexico. Nine females outfitted with satellite transmitters showed almost identical pathways off the nesting beach where they moved south and, upon encountering the North Equatorial Current at about 8°N, diverted west for approximately 800 km and then moved east/southeast towards the waters off Peru and Chile (Eckert, 1999). These studies underscore the importance of these offshore areas to highly migratory sea turtles and the likelihood that sea turtles are present on fishing grounds.

Until closed by international agreement in 1992, incidental capture of leatherbacks in high seas drift nets deployed by foreign fishing vessels may have been significant in the high seas. Seven genetic samples from leatherbacks taken in the U.S. Hawaii longline fishery indicate representation from both the western (5) and eastern Pacific (2) populations of leatherbacks (Dutton *et al.*, (in press)). Because leatherbacks are highly migratory and they mix in high seas foraging areas, leatherbacks from breeding colonies located south of the equator in Indonesia and in the eastern Pacific along the Americas (e.g., Mexico, Costa Rica) are likely to contribute to pelagic populations in the ETP.

<u>Green Turtle</u>

Green turtles are listed as threatened, except for breeding populations found in Florida and the Pacific coast of Mexico, which are listed as endangered. The genus *Chelonia* is generally regarded as comprising two distinct subspecies, the eastern Pacific (so-called "black turtle," *C. m. agassizii*), which ranges from Baja California south to Peru and west to the Galapagos Islands, and the nominate *C. m. mydas* in the rest of the range. Since both subspecies can be found in the ETP, and are generally referred to as green or black turtles, for the purposes of this biological opinion, NMFS will treat them as one species.

Green turtles are declining virtually throughout the tropical Pacific, with the possible exception of Hawaii, as a direct consequence of an historical combination of overexploitation and habitat loss (Eckert, 1993). They are a circumglobal and highly migratory species, nesting mainly in tropical and subtropical regions. In Hawaii, green turtles lay up to six clutches of eggs per year (mean of 1.8), and clutches consist of about 100 eggs each. Females migrate to breed only once every two or possibly many more years, although the common remigration intervals reported for several rookeries worldwide are two and three years (Eckert, 1993; NMFS and USFWS, 1998c). They prefer waters that usually remain about 20°C in the coldest month; for example, during warm spells, green turtles may be found considerably north of their normal distribution. They are the only marine turtle with a nearly exclusive herbivorous diet, consisting primarily of sea grass and algae (Wetherall *et al.*, 1993). The non-breeding range of green turtles is generally tropical, and can extend approximately 500-800 miles from shore in certain regions (Eckert, 1993).

In the Pacific, major (> 2,000 nesting females) populations of green turtles occur in Mexico, Australia, and Malaysia. Smaller colonies occur in the insular Pacific islands of Polynesia, Micronesia, and Melanesia (Wetherall *et al.*, 1993) and on six small sand islands at French Frigate Shoals, a long atoll situated in the middle of the Hawaiian Archipelago (Balazs, 1995).

The primary green turtle nesting grounds in the eastern Pacific are located in Michoacán, Mexico, and the Galapagos Islands, Ecuador (NMFS and USFWS, 1998c). Here, green turtles were widespread and abundant prior to commercial exploitation and uncontrolled subsistence harvest of nesters and eggs. More than 165,000 turtles were harvested from 1965 to 1977 in the Mexican Pacific. In the early 1970s nearly 100,000 eggs per night were collected from these nesting beaches. The nesting population at Michoacán decreased from 5,585 females in 1982 to 940 in 1984. Despite long-term protection of females and their eggs on the main nesting beach in Michoacán, the population continues to decline, and it is believed that adverse impacts (including incidental take in various coastal fisheries as well as illegal directed take at forage areas) continue to prevent recovery of endangered populations (P. Dutton, NMFS, personal communication, 1999). On another major nesting beach in Mexico (Colola), an estimated 500-1,000 females nested nightly in the late 1960s. In the 1990s, that number has dropped to 60-100, or about 800-1,000 turtles per year. There are no historical records of abundance of green turtles from the Galapagos - only residents are allowed to harvest turtles for subsistence, and egg poaching occurs only occasionally. An annual average of 1,400 nesting females was estimated for the period 1976-1982 in the Galapagos Islands (NMFS and USFWS, 1998c).

The nesting population of green turtles in Hawaii appears to have increased over the last 17 years. However, this encouraging trend is tempered by poaching and incidental capture in nearshore gillnets and longline gear. Also, the green turtle population in this area is afflicted with a tumor disease, fibropapilloma, which is of an unknown etiology and often fatal. Ninety percent of nesting in Hawaii occurs at the French Frigate Shoals, where 200-700 females are estimated to nest annually (NMFS and USFWS, 1998c).

Tag returns of eastern Pacific green turtles (often reported as black turtles) establish that these turtles travel long distances between foraging and nesting grounds. In fact, 75 percent of tag recoveries from 1982-90 were from turtles that had traveled more than 1,000 kilometers from Michoacán, Mexico. Even though these turtles were found in coastal waters, the species is not confined to these areas, as indicated by 1990 sightings records from a NOAA research ship. Observers documented green turtles 1,000-2,000 statute miles from shore (Eckert, 1993). The east Pacific green is also the second-most sighted turtle in the east Pacific during tuna cruises; they are frequent along a north-south band from 15°N to 5°S along 90°W, and between the Galapagos Islands and Central American Coast (NMFS and USFWS, 1998c).

Green turtles encountered during purse seine fishing in the ETP may originate from a number of known proximal, or even distant, breeding colonies in the region. However the most likely candidates would include those from Hawaii (French Frigate Shoals) and the Pacific coast of Mexico population. This is based on limited genetic sampling conducted within the NMFS observer program for the U.S. Hawaii-based longline fishery (1 turtle from Hawaii and 3 turtles from the eastern Pacific Mexican population (Dutton *et al.*, in press)).

Hawksbill Turtle

The hawksbill turtle is listed as endangered throughout its range. There is little information on the biology of hawksbills most likely because they are sparsely distributed throughout their range and they nest in very isolated locations (Eckert, 1993). Nevertheless, hawksbills appear to be declining throughout their range. Anecdotal reports throughout the Pacific indicate that the current population is well below historical levels. Like other sea turtles, hawksbills are highly migratory, although they are less of a long-distant migrant. They are found in all tropical seas between about 30°N and 30°S latitudes, where the water is less than 16 meters deep and reefs, shoals, and estuaries are present (King, 1995). They are generally associated with coral reefs or other hard substrate structures close to shore where they feed on sponges and small crustaceans.

Although hawksbill nesting is broadly distributed, at no one place do hawksbills nest in large numbers, and many areas have experienced notable declines. There is much variation in clutch size from site to site and among sizes of turtles, with the larger turtles laying the largest clutches. Known clutch size in the Pacific averages 130 eggs per clutch, around 3 clutches per year, and anecdotal reports indicate that hawksbill remigration intervals average around two years (Eckert, 1993; NMFS and USFWS, 1998d). The largest nesting concentrations of hawksbills occur on remote oceanic islands off Australia (Torres Strait), while remote beaches in the Solomon Islands, Papua New Guinea, Indonesia, and Malaysia serve as less significant sites. Otherwise, hawksbill nesting does not occur in abundance in the Pacific. Throughout Micronesia, hawksbill nesting is in a grim decline, with Palau representing the highest activity, with conceivably as few as 20 nesting females per year (NMFS and USFWS, 1998d). In Japan, nesting is very rare and is confined to the southern islands. Hawksbill nesting also occurs in Viet Nam and China, although the status in these areas is unknown. Nesting is widespread throughout the Philippines, although the sites are relatively poorly known, and population abundance has not been quantified (Eckert, 1993).

Small numbers of isolated but consistent hawksbill nest sites are found on the islands of Molokai and Hawaii in the main Hawaiian islands. In addition, recent nesting activity has occurred at Kealia Beach on Maui. Although total population numbers and trends in abundance are not known for the Hawaiian population of hawksbill turtles, probably no more than 35 females nest annually on all beaches combined (J. Wetherall, NMFS, personal communication, 1999).

By far the most serious problem hawksbill turtles face is the harvest by humans, while a less significant threat, but no less important, is loss of habitat due to expansion of resident human populations and/or increased tourism development. Dramatic reductions in the numbers of nesting and foraging hawksbills have occurred in Micronesia and the Mexican Pacific coast, probably due largely to technological advances in fishing gear, which facilitate legal and illegal harvest. In addition, the hawksbill tortoiseshell trade probably remains an important contributing factor in the decline of the hawksbill. Although the Japanese market was closed in 1994, southeast Asia and Indonesia markets remain lucrative (NMFS and USFWS, 1998d).

<u>Olive Ridley Turtle</u>

The olive ridley populations on the Pacific coast of Mexico are listed as endangered; all other populations are listed as threatened. They are the smallest living sea turtle (NMFS and USFWS, 1998e), and, like leatherbacks, most olive ridleys lead a completely pelagic existence (Plotkin *et al*., 1993). The olive ridley is migratory throughout the Pacific, from their nesting grounds in Mexico and Central America to the north Pacific. Satellite tracking of post-nesting olive ridleys from Costa Rica showed a wide dispersion, ranging from Mexico to Peru and more than 3,000 kilometers out into the central Pacific (Plotkin *et al*. 1993). Although their critical foraging areas are unknown, these sea turtle species appear to forage throughout the ETP, often in large groups. Olive ridleys feed on tunicates, salps, crustaceans, other invertebrates and small fish. Though they are generally thought to be surface feeders, olive ridleys have been caught in trawls at depths of 80-110 m (NMFS and USFWS, 1998e).

Olive ridley turtles are the most abundant sea turtle in the Pacific basin. However, although these turtles remain relatively widespread and abundant, most nest sites support only small or moderate-scale nesting, and most populations are known or thought to be depleted. The mean clutch size for Mexican populations is 105.3 eggs, while in Costa Rica, clutch size averages between 99 and 107 eggs (NMFS and USFWS, 1998e). Females generally lay two clutches of eggs per season in Costa Rica (Eckert, 1993). Data on the remigration intervals of olive ridleys are scarce.

In the eastern Pacific, nesting occurs all along the Mexico and Central American coast, with large nesting aggregations occurring at a few select beaches located in Mexico and Costa Rica. Where population densities are high enough, nesting takes place in synchronized aggregations known as *arribadas*. The largest known *arribadas* in the eastern Pacific is off the coast of Costa Rica (~475,000 - 650,000 females estimated nesting annually) and in southern Mexico (~200,000+ nests/year) (Eckert, 1993; NMFS and USFWS, 1998e). Historically, it was estimated that over 10 million olive ridleys inhabited the waters in the eastern Pacific off Mexico. However, human-induced mortality has led to declines in this population. For example, 1 million olive ridleys were harvested in Mexico in 1968 (NMFS and USFWS, 1998e). Since this directed take of sea turtles was closed in the early 1990s, the nesting populations in Mexico appear to be recovering, with females nesting in record numbers in recent years (Marquez, *et al.*, 1995). The greatest single cause of olive ridley egg loss comes from the nesting activity of conspecifics on *arribada* beaches, where nesting turtles destroy eggs by inadvertently digging up previously laid nests or causing them to become contaminated by bacteria and other pathogens from rotting nests nearby. At a nesting site in Costa Rica, an estimated 0.2 percent of 11.5 million eggs laid during a single *arribada* produced hatchlings (*in* NMFS and USFWS, 1998e).

In the western Pacific, olive ridley nesting is known to occur on the eastern and western coasts of Malaysia; however, the area has experienced a rapid decline in the past decade. For example, the highest density of nesting was reported to be in Terengganu, Malaysia, and at one time yielded 240,000 eggs (Siow and Moll, 1982, *in* Eckert, 1993)), while only 187 nests were reported from the area in 1990 (Eckert, 1993).

Surprisingly little is known of the oceanic distribution of the olive ridley, despite being the most populous of north Pacific sea turtles. Available information suggests that the olive ridley regularly uses the ETP pelagic region for foraging and/or developmental migrations. Based on nearly 15 years of data, Pitman (1990, *in* Eckert, 1993) describes the range of the olive ridley in the ETP as bounded to the north by the cold California Current, and to the south by the cold Humboldt Current, which veers northwest off the coast of northern Peru at about 5°S. Of 247 positively identified olive ridleys, most were observed between the mainland and 120°W (*in* Eckert, 1993). Olive ridleys are occasionally found entangled in scraps of net or other floating debris. In a three year study of communities associated with floating objects in the ETP, Arenas and Hall (1992, *in* Eckert, 1993) found sea turtles, 75 percent of them olive ridleys, present in 15 percent of observations and suggested that flotsam may provide the turtles with food, shelter, and/or orientation cues in an otherwise featureless landscape. In addition, small crabs, barnacles and other marine life often reside on the debris and likely serve as food attractants to turtles. Juveniles and subadults are also known to be present in ETP waters.

While it is true that olive ridleys generally have a tropical range, individuals do occasionally venture north, some as far as the Gulf of Alaska. The postnesting migration routes of olive ridleys, tracked via satellite from Costa Rica, traversed thousands of kilometers of deep oceanic waters and were geographically distributed over a very broad range (from Mexico to Peru and 3,000+ km west of Costa Rica) (Plotkin *et al*. 1993).

Recent genetic information from 15 olive ridley samples taken in the Hawaii-based longline fishery indicate that 9 of the turtles originated from the eastern Pacific and 6 of the turtles were from the southwest or Indo-Pacific (i.e. Malaysia) (P. Dutton, NMFS, personal communication, 1999).

B. Factors Affecting Sea Turtles in the Pacific Ocean

<u>A. Fisheries impacts</u>

I. North Pacific Driftnet Fisheries

Foreign high-seas driftnet fishing in the north Pacific Ocean for squid, tuna and billfish ended with a United Nations moratorium in December, 1992. Except for observer data collected in 1990-1991, there is virtually no information on the incidental take of sea turtle species by the driftnet fisheries prior to the moratorium. The cessation of high-seas driftnet fishing should have reduced the incidental take of listed species. However, nations involved in driftnet fishing may have shifted to longline fishing worldwide, or to coastal gillnet operations within their respective Exclusive Economic Zones (EEZ), thereby increasing or maintaining the take of sea turtles. Without operational data from these fisheries, a true measure of the effect on sea turtles cannot be made.

The high seas squid driftnet fishery in the North Pacific was observed in Japan, Korea, and Taiwan and was estimated to have taken a total of 655 sea turtles in 1990, with an estimated mortality of 131 sea turtles (Table 1). Estimates of sea turtle take by the Japan fleet were based on apportionment by species (including unidentified species) according to the observed species composition from observer data. Sample sizes for the incidental take of sea turtles in the same fishery for the Korea and Taiwan fleets in 1990 were too small to allow a reliable apportionment by species. In addition, the Japanese squid driftnet fishery was estimated to take 222 leatherbacks and 251 other sea turtles in 1989 (Wetherall *et. al*, 1993). The available data do not indicate whether this take was mortal or just capture/entanglement.

Table 1. **Estimated bycatch and mortality (in parenthesis) of sea turtles in the 1990 squid driftnet fisheries of Japan, Korea, and Taiwan (Wetherall, *et al.*, 1993).**

Species/Country	Japan	Korea	Taiwan	Total
leatherback	300	–	–	--
loggerhead	5	–	–	--
unidentified	101	–	–	–
TOTAL	406 (81)	221	28	655 (131)

Preliminary analysis of the 1990-91 data for the large-mesh fisheries indicated that an estimated combined total of 456 leatherbacks, 4,689 loggerheads, 248 greens, and 8 hawksbills were taken by the Japanese fleet (1990-91) and the Taiwanese fleet (1990) (Table 2). Again, the species composition of the total sea turtle by-catch was apportioned by observed percentages and extrapolated to total reported effort. Estimation of the incidental takes for leatherbacks and other species for the Taiwanese fleet was complicated by the commingling of total fleet driftnet effort for the squid and large-mesh gear.

Table 2. Estimated bycatch and mortality (in parenthesis) of sea turtles in the large-mesh driftnet fishery of Japan (1990-91) and Taiwan (1990 only).

Species/Country	Japan	Taiwan	Total
leatherback	45 (0)	411 (103)	456 (103)
loggerhead	1,200 (264)	3,489 (1,116)	4,689 (1,380)
green	248 (74)	0	248 (74)
hawksbill	8 (8)	0	8 (8)
TOTAL	1,501 (346)	3,900 (1,219)	5,401 (1,565)

These rough mortality estimates for single fishing seasons provide only a narrow glimpse of the impacts of the driftnet fishery on sea turtles, and a full assessment of impacts would consider the turtle mortality generated by the driftnet fleets over their entire range. Unfortunately sufficient data are lacking, but the 1990 observer data does indicate the possible magnitude of turtle mortality given the best information available. Wetherall *et al.* (1993) speculates that the actual mortality of sea turtles may have been between 2,500 and 9,000 per year, with most of the mortalities being loggerheads taken in the Japanese and Taiwanese large-mesh fisheries.

A comprehensive, reliable assessment of the impacts of the North Pacific driftnet fishery on turtles is impossible without a better understanding of turtle population sizes and status, stock origins, exploitation history and population dynamics. It is likely that the mortality inflicted by the driftnet fisheries in 1990 and in prior years was significant (Wetherall *et al.* (1993)), and the effects may still be evident in sea turtle populations today. The loss of juvenile, pre-reproductive adults, and reproductive adults to the driftnet fishery has probably altered the current age structure (especially if certain age groups or types were more vulnerable to driftnet fisheries) and therefore diminished or limited the reproductive potential of affected sea turtle populations.

II. North Pacific and South China Sea longlines and bottom trawls

Nishimura and Nakahigashi (1990) estimated that 21,200 turtles, including loggerheads, greens, leatherbacks, hawksbills and olive ridleys were captured each year in tuna longlines and bottom trawls, with a reported mortality of 12,300 turtles per year. These estimates were based on turtle sightings and capture rates reported in a survey of fisheries research and training vessels and extrapolated to total longline fleet effort. Using commercial logbooks, research-vessel data and questionnaires from longliners from 1988, Nishimura estimated that for every 10,000 hooks in the north Pacific and South China Sea, one turtle is snagged, with a survival rate of only 42 percent. Because the data collected by Nishimura and Nakahigashi was based on observations by training and research vessels, logbooks and a questionnaire, it may contain large biases and assumptions. Therefore, the accuracy of the estimated take and mortality of sea turtles is questionable. In addition, NMFS is unaware of any follow-up studies, or whether there have been changes in the coastal trawl and longline fisheries since 1990 (J.Wetherall, personal communication, 1999). The continuing impacts of these fisheries, however speculative, may still have a significant impact on sea turtle populations. Future investigations into the impacts of these fisheries would allow a more complete assessment of cumulative effects on pelagic sea turtles in the Pacific Ocean.

III. Chilean fisheries

From 1987 the Chilean swordfish driftnet fishery expanded rapidly with many hundreds of boats concentrated primarily in four ports - Chañaral, Valparaiso, San Antonio, and Concepcion. Most of these vessels were small (14-15 meters) and switched from a harpoon fishery to a driftnet fishery. Although data on incidental takes for sea turtles in this fishery are sparse, both green and leatherback turtles have been confirmed taken and killed in the driftnet fishery for swordfish. Data were recorded opportunistically for a single port (San Antonio) over a two year period. This partial record showed leatherback captures and sightings totaling 9 in 1988 and 21 in 1989. A rough estimate of 250 leatherback takes per year without differentiating between kills and total takes for vessels operating out of San Antonio was provided (Frazier and Brito Montero, 1990). This fishery peaked in 1993 and has since declined significantly due to concerns about possible overfishing of swordfish.

Adult female leatherbacks tagged in Mexico have been taken in Chilean waters by gillnet and purse seine fisheries (Marquez and Villanueva, 1993). Although data regarding total fishing effort are fairly complete, there is very little information on lethal and non-lethal incidental catch per unit effort.

IV. Fisheries in the Federated States of Micronesia

Incidental capture of sea turtles was reported by observers aboard tuna purse seine and longline vessels licensed to fish in the EEZ of the Federated States of Micronesia for the years 1980-1993. Seven of the thirteen turtles reported taken by longliners were unidentified and released alive and unharmed. The remainder included 1 hawksbill, 2 leatherbacks, and 3 olive ridleys. Only one turtle, an olive ridley, was reported as killed; the rest were released alive and unharmed. For purse seiners fishing in Micronesia, 7 sea turtles were reported incidentally captured, with 2 hawksbills, 2 olive ridleys, and 3 recorded as unidentified. One olive ridley, one hawksbill and two unidentified turtles, were released alive and unharmed, one hawksbill was reported as dead/discarded, one olive ridley was injured in the power block, and the condition of one unidentified turtle was unknown (Thoulag, 1993).

V. Western Pacific U.S. tuna purse seine fishery

Commercial fishing for tropical tunas in the western Pacific by U.S.-registered purse seiners has been managed according to requirements of the South Pacific Regional Tuna Treaty since June, 1988. The treaty was signed by the United States and 16 Pacific island countries, and provides U.S. tuna purse seiners access to tunas in a 25.9 million km^2 area of the central-western Pacific Ocean in exchange for fishing fees and adherence to rules related to closed area, etc. The agreement ends in 2003 (Coan, *et al*., 1997). In 1998, most of the U.S. fleet, which consisted of 39 vessels, fished between 165°W and 155°E longitude and between 10°N and 10°S latitude (Coan, *et al*., 1999). Because there is not the characteristic tuna-dolphin association in the western Pacific as there is in the ETP, U.S. fishermen set on floating objects (logs and FADs) and schools to catch tuna. The U.S. fleet is required to take observers on a minimum of 20 percent of their fishing trips. In 1998, observers recorded one loggerhead turtle taken, although it is unclear as to whether the turtle was released unharmed, injured or killed (Coan, *et al*., 1999). From June, 1997 to June, 1998, observers anecdotally (recorded in their logbooks) observed one green turtle taken and released unharmed, and one unidentified turtle taken and released unharmed (Forum Fisheries Agency, 1998). Extrapolating this information based on percentage of observer coverage, the entire U.S. western Pacific fleet may capture 5 loggerhead, 5 green, and 5 unidentified sea turtles each year.

B. Other impacts

Threats to sea turtles vary among the species, depending on their nesting, migration, and foraging patterns. In addition, some sea turtle species are valued for their meat or eggs, such as the green turtle, while others are coveted for their shell, such as the hawksbill. All sea turtle life stages are vulnerable to human-induced mortality. On nesting beaches, direct exploitation of turtles for meat, eggs, hides, and other products takes place for both commercial markets and local utilization. Furthermore, on nesting beaches and in nearshore waters, habitat degradation and destruction have occurred from such diverse factors as coastal development, dredging, vessel traffic, erosion control, sand mining, vehicular traffic on beaches, and artificial lighting, which repels the adults and disorients the hatchlings. Human alteration of terrestrial habitats can also change the feeding patterns of natural predators, thereby increasing predation on marine turtles' nests and eggs.

Petroleum and other forms of chemical pollution affect turtles throughout their marine and terrestrial habitats. Direct poisoning, as well as blockage of the gastrointestinal tract by ingested tar balls, has been reported. Low level chemical pollution, possibly causing immunosuppression has been suggested as one factor in the epidemic outbreak of a tumor disease (fibropapilloma) in green turtles. Plastics and other persistent buoyant debris discharged into the ocean are also recognized as harmful pollutants in the pelagic environment. Both the entanglement in, and ingestion of, this synthetic debris have been documented (*in* Wetherall, *et al*., 1993).

C. Status of the Species Summary

All listed sea turtle populations affected by the proposed action have been impacted by human-induced factors such as commercial fisheries, direct harvest of turtles, and modification or degradation of the turtle's terrestrial and aquatic habitat. Terrestrial habitat impacts have generally resulted in the loss of eggs or hatchling turtles, or nesting females. Aquatic habitat impacts have caused the mortality of juvenile and adult sea turtles through ingestion of debris or pollution. The loss of juvenile turtles, including eggs, has likely impacted the species' ability to maintain or increase its numbers by limiting the number of individuals that survive to sexual maturity. In addition, the loss of adult females results in the loss of their possible future reproductive output. The age of sexual maturity of most species of sea turtles is currently unknown. The sexual maturity of loggerheads may be as high as 35 years, while green turtles may not reach maturity until 30-60 years (in Crouse, 1999). Upon reaching maturity, female sea turtles generally lay between 100-130 eggs per clutch, 2-3 clutches per year, every 2-4 years. Thus, in general, a female sea turtle will lay between 200-390 eggs per season, every 2-4 years. The potential for an egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult sea turtle will vary among species, populations, and the degree of threats faced during each life stage. Females killed prior to their first successful nesting will have contributed nothing to the overall maintenance or improvement of the species' status. Females killed after their first successful nesting may have produced some juvenile turtles that survive to sexual maturity. It is unknown how these impacts have affected the species replacement of itself – that is, the ability of an individual of the species to replace itself within the population, thereby maintaining population numbers. In a stable or growing population, individuals of a species typical replace themselves at a 1:1 or higher ratio. Given the continuing declines of most populations of listed sea turtle species in the Pacific Ocean, it is likely that individuals of the population are not currently able to replace themselves.

IV. Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the action area.

Many of the impacts described in the previous section also affect sea turtle populations in the ETP. Most sea turtle species migrate very long distances between nesting sites and foraging areas, as indicated by tag and recapture studies. For example, a sea turtle that originated from Japan may be impacted by an Hawaiian longliner in the northern Pacific.

In some areas of the ETP, the locations of important nesting beaches have been determined. However, studies of sea turtles at these sites usually have been limited to monitoring trends in the counts of nesting females. Consequently, population abundance estimates within the ETP and the surrounding areas are not available for most species. Furthermore, the at-sea distribution and abundance of turtles in this region is not well known.

Fisheries Impacts

Fisheries other than the U.S. tuna purse seine fishery in the ETP incidentally take sea turtles. U.S. fisheries include the California gillnet fisheries, west coast longline fishery, Hawaii-based longline fishery, U.S. albacore troll fishery, and the Hawaii nearshore gillnet fishery. In addition, many of the foreign or foreign regulated fisheries (e.g. longline, coastal gillnet, trawl, etc.) may be significant sources of incidental take and mortality of sea turtles in the ETP. There are other fisheries in Southeast Asia and the eastern Pacific for which NMFS has no current information regarding incidental take of sea turtles. The degree to which each fishery may or may not contribute to the overall decline of sea turtles is indeterminable due to the lack of comprehensive information about the fisheries interactions. However, a review of these fisheries and any known effects and impacts are included, based on limited available data.

California gillnet fisheries

California drift gillnetters generally fish from the California/Mexico border (30°N latitude) to the northern Oregon border (45°N) and as far west as 129°W, while the set gillnetters generally fish within 12 miles of the Californian coastline, north to Monterey Bay (Julian and Beeson, 1998).

Halibut and angel shark set gillnet fishery

The California set gillnet fishery for halibut and angel shark has been observed to take sea turtles (NMFS, 1995). In July, 1990, NMFS implemented an observer program for this fishery in order to monitor marine mammal bycatch. NMFS observer coverage ranged from 0% to 15.4% between July, 1990 and July, 1994. The observer program for the set gillnet fishery was terminated in July, 1994 because of a significant decrease in fishing effort in that fishery (due to regulations that restricted areas open to gillnet fishing) (Julian and Beeson, 1998). In April, 1999, the set gillnet fishery off Monterey was again monitored, but no sea turtle interactions have yet been reported (R. Rasmussen, NMFS, personal communication, 1999). The following table provides a summary of observed and estimated sea turtle mortalities by species in this fishery from 1990 to 1994. Four of the observed mortalities occurred offshore of Ventura, California. In addition to mortalities, two unidentified sea turtles were observed entangled and released alive in 1993 (estimated total take=13). Five unidentified turtles were estimated (no observer coverage) to have been entangled in 1995. These estimates were based on stratified rates from 1993 results (Julian and Beeson, 1998) and will therefore not be used in the analysis of effects.

Table 3. Observed and estimated (in parenthesis) sea turtle mortalities in the California set gillnet fishery for halibut and angel shark from 1990-95[1].

Species/Year	1990	1991	1992	1993	1994	1995[2]
green turtle	0 (0)	0 (0)	1 (8)	1 (6)	0 (0)	(2)
loggerhead	0 (0)	0 (0)	1 (8)	0 (0)	0 (0)	(0)
leatherback	0 (0)	0 (0)	0 (0)	0 (0)	1 (8)	(0)
unidentified	0 (0)	0 (0)	0 (0)	1 (6)	0 (0)	(2)

[1]From Julian and Beeson (1998).
[2]Estimates for 1995 were based on stratified rates from 1993 results (Julian and Beeson, 1998)

Swordfish and shark drift gillnet fishery

In addition to the set gillnet fishery for halibut and angel shark, observers have recorded data from the swordfish and shark drift gillnet fishery since 1990. Tables 4 and 5 review the observed and estimated mortality and entanglement of sea turtles in this fishery. Of the 25 sea turtles observed taken, 13 were released alive (Julian and Beeson, 1998). Recent results from genetic studies have identified the nesting populations of the sea turtles taken in this drift gillnet fishery to the western Pacific stocks of leatherbacks (2 of 2 specimens) and the Japanese stock of loggerheads (4 of 4 specimens) (P. Dutton, NMFS, personal communication, 1999).

Table 4. Observed and estimated (in parenthesis) sea turtle entanglements[1] in the swordfish and shark drift gillnet fishery[2].

Species/year	1990	1991	1992	1993	1994	1995	1996[3]	1997[3]	1998[3]
leatherback	1 (23)	1 (10)	4 (29)	3 (22)	1 (6)	5 (32)	2	4	0
loggerhead	0 (0)	0 (0)	2 (15)	5 (37)	0 (0)	0 (0)	0	3	4
unidentified	0 (0)	0 (0)	0 (0)	3 (22)	0 (0)	0 (0)	0	0	0

[1]Entanglements includes turtles that were dead or released alive
[2]From Julian and Beeson (1998).
[3]From R. Rasmussen, NMFS, personal communication, 1999, and Cameron (1999).

Table 5. Observed and estimated (in parenthesis) sea turtle mortalities in the swordfish drift and shark drift gillnet fishery[1].

Species/year	1990	1991	1992	1993	1994	1995	1996[3]	1997[3]	1998[3]
leatherback	1 (23)	0 (0)	2 (15)	2 (15)	0 (0)	4 (26)	2 (24)	2 (7)	0 (0)
loggerhead	0 (0)	0 (0)	1 (7)	0 (0)	0 (0)	0 (0)	0 (0)	1 (6)	2[2](5)
unidentified	0 (0)	0 (0)	1 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

[1]From Julian and Beeson (1998).
[2]includes one dead turtle, one injured turtle
[3]From R. Rasmussen, NMFS, personal communication, 1999.

U.S. albacore troll fishery

Anecdotal information indicates that there are rare occurrences of sea turtles taken in the U.S. albacore troll fishery. Mortality or serious injury does not appear to occur from these interactions, and effects on individual turtles are likely not significant. Data on bycatch of species other than finfish have not been compiled (J. Wetherall, NMFS, personal communication, 1999).

Other coastal gillnet/longline fisheries

Coastal gillnets and longline fisheries in other countries of the eastern Pacific likely take sea turtles incidentally to their operations. However, the extent of the fisheries and magnitude of the take are not known.

Hawaii-based longline fishery

The Hawaii longline fishery ranges over 2,000 nautical miles (nm) of latitude from waters well south of the Hawaiian Archipelago to waters north of the islands in the North Pacific Transition Zone (Wetherall, 1993). Only limited quantitative data exist on the number of sea turtles caught by the Hawaiian longline fishery and the immediate or consequent injury and mortality that take place. Information on the likelihood of fishery interactions with each species has been collected by scientific observers deployed by NMFS since February 1994. Table 6 shows the estimated total incidental takes and mortalities of sea turtles in the Hawaiian longline fishery from 1994-1997.

Table 6. Estimated incidental take and mortality (in parenthesis) of sea turtles in the Hawaiian longline fishery, based on a regression tree model[1].

Species/Year	1994	1995	1996	1997
loggerhead	476 (83)	376 (66)	426 (75)	284 (50)
leatherback	162 (7)	176 (7)	175 (7)	178 (7)
olive ridley	101 (26)	110 (28)	109 (28)	111 (28)
green	27 (0.4)	29 (0.5)	29 (0.5)	29 (0.5)
TOTAL	766 (116.4)	691 (101.5)	739 (110.5)	602 (85.5)

[1]From NMFS (1998b). Mortalities are a subset of total incidental take.

In its November 3, 1998, biological opinion on the impacts of the fishery management plan for the Hawaii-based longline fishery on listed species, NMFS estimated the maximum annual incidental takes and mortalities of sea turtles for 1998-2001: loggerheads - 489 taken, 103 killed; olive ridleys - 168 taken, 46 killed; leatherbacks - 244 taken, 19 killed, and hawksbills - 2 taken, 1 killed (NMFS, 1998b).

ETP tuna purse seine fishery

A. U.S. Fleet

In 1999, the United States had a fleet capacity limit of 8,969 metric tons of tuna; this included both larger (>400 st carrying capacity) and smaller vessels and was based on the number of vessels fishing in 1998. Based on historical trends since the early 1990s, NMFS does not expect this fleet capacity limit to vary significantly in the future. For instance, the number of large ETP tuna purse seine vessels has remained steady since 1992, varying between 5 and 7 vessels, and the number of smaller vessels has also remained steady, averaging 18 vessels between 1993 and 1997. Although all large tuna purse seine vessels (>400 st) fishing in the ETP for tuna have been required to carry observers since 1989, smaller purse seine vessels are not required to carry observers. Thus, no data are available on sea turtle interactions with the small tuna purse seine vessels in the ETP.

Larger (> 400 st) vessels

An average of six U.S. tuna purse seine vessels greater than 400 st carrying capacity fished in the ETP from 1993 to 1997. Currently, seven large tuna purse seine vessels fish for tuna in the ETP. As a result of statutory requirements, large U.S. tuna purse seine vessels have not fished on dolphin to catch tuna since 1995. In the early 1990s, U.S. purse seine vessel operators discovered that fishing on floating objects (including FADs) with deeper nets resulted in catches of bigeye tuna, which generally command the same price as yellowfin tuna. Thus, fishing on floating objects has become the preferred fishing strategy for this fleet, although they also continue to fish on tuna schools.

In response to concerns regarding continued high annual dolphin mortalities caused by the entire ETP tuna purse seine fleet, Congress amended the MMPA in 1988, requiring all large U.S. purse seine vessels to carry an observer onboard every fishing trip. In addition to collecting data on the take of marine mammals incidental to fishing operations, these observers also began collecting data on sea turtle bycatch in 1990. Five years of data (1990-1994) were collected by NMFS-trained observers on 100 percent of all U.S. vessels fishing in the ETP. After 1994, IATTC observers collected data on U.S. vessels, and since that time, the IATTC has maintained the data set. Data is submitted to NMFS upon request.

In addition to collecting tuna life history and marine mammal and bycatch data during a set, observers complete a sea turtle life history form when a sea turtle is taken in a set (i.e., sea turtle was captured or at any time entangled in the net). "Capture" refers to turtles observed within the perimeter of the net at rings up (the net is pursed), while "entangle" includes any turtle observed trapped in the webbing at any time during the set, including the outside perimeter. "Escape" referred to any turtle which was observed leaving the net unaided and uninjured. The "escaped" turtles were often the result of turtles entangled outside the net and dropping free during net roll. Because sea turtles have extremely slow metabolic rates and take a long time to die, observers are instructed to keep possibly freshly captured turtles that come aboard the vessel, and appear dead, in the shade, wet, and with their rear flippers higher than their head. This is to allow any turtles time to revive if they are comatose, which is often difficult to distinguish from actually dead turtles. A "previously dead" turtle (not killed by the set it was captured in) is relatively easy for an observer to determine--signs include bloating, sloughing skin, and missing eyes (R. Rasmussen, NMFS, personal communication, 1999).

Table 7 shows sea turtle interactions in the U.S. tuna purse seine fleet (vessels with greater than 400 st carrying capacity) from 1990 to 1997. Data for 1998 and most of 1999 has not been entered into a database and is therefore, currently unavailable. From 1990-94, the U.S. fleet set <u>on dolphins</u> and took an average of 37 sea turtles per 1,000 sets (87 sea turtles/2,335 sets). From 1990-97, when setting <u>on tuna schools</u>, the U.S. fleet incidentally took an average of 75 sea turtles per 1,000 sets (214 sea turtles/2,861 sets), and when setting <u>on floating objects</u>, the U.S. fleet incidentally took an average of 234 sea turtles per 1,000 sets (796 sea turtles/3,396 sets). Since sea turtles tend to associate with floating objects, and not dolphins, the chances of taking a sea turtle are much greater (six-fold increase) when setting on a floating object compared to setting on dolphins.

During 1990-97, seven turtles were killed accidentally (6 olive ridleys and 1 unidentified), 0.6 percent of all turtles captured, while 1,002 of all turtles incidentally taken during fishing operations were released unharmed (approximately 90 percent). In addition to sea turtles killed accidentally or released unharmed in the U.S tuna purse seine fishery, 3.8 percent were released with light injuries (sea turtles with grave injuries which were believed to lead to death were coded as mortalities). The rest of the sea turtles encountered by the U.S. fleet were either dead prior to the set (<1 percent), escaped from the net (>3 percent), or were recorded as unknown (>1 percent). Of the identified species taken during 1990-1997, 82 percent were olive ridleys, 16 percent were green turtles, and leatherbacks, hawksbill, and loggerheads each comprised about 0.6 percent.

The 1990-1997 data also indicates that 174 turtles taken by the U.S. tuna purse seine fishery during this period were "unidentified," although only 1 of these unidentified turtles is listed as accidentally killed. Most of these sea turtles probably never came on board, but escaped after being encircled or captured, and the observer was not close enough to identify the turtle as it swam away. Assuming that these unidentified turtle interactions occurred in the same proportions as the identified sea turtle interactions, these 174 turtles would most likely be comprised of 143 olive ridleys, 28 green turtles, and 1 to 3 leatherback, hawksbill or loggerhead turtles, in unknown proportion. It is likely that most of these 174 unidentified turtles were uninjured by their capture or encirclement if they did release themselves from the net and swim away.

Smaller (< 400 st) vessels

The U.S. fleet includes a number of purse seine vessels that have a 400 st or less carrying capacity and that occasionally target tuna in the ETP. From 1993 to 1997, an average of 18 vessels in this size category fished in the ETP each year. These smaller vessels fish for tuna on a seasonal basis, with summer tuna fishing usually completed by the end of October. Most of the year, the smaller vessels fish primarily for coastal pelagic finfish species off southern and central California.

No data is available on whether sea turtles are incidentally taken by small vessels in the ETP tuna purse seine fishery. Most smaller tuna vessels fishing off southern California fish on tuna schools because the vessels are old, slow, and lack the resources (e.g. helicopters) needed to place and find floating objects (B. Jacobson, NMFS, personal communication, 1999). Based on observer data from the large vessels, the chances of incidentally capturing a sea turtle during a school set are much less than incidentally capturing a sea turtle during floating object sets. NMFS believes that the capture of sea turtles in the small vessel fleet is rare.

Table 7. Sea turtle interactions by U.S. tuna purse seine fleet (1990 - 1997)

Set Summary / by calendar year 1/1 - 12/30									
Cruise Year	**1990**[1]	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**Total**
School Set	469	377	254	486	506	152	385	232	**2861**
Dolphin Set	1000	430	654	201	50	0	0	0	**2335**
Floating obj. set	345	496	329	468	321	434	403	600	**3396**
Total Sets	**1814**	**1303**	**1237**	**1155**	**877**	**586**	**788**	**832**	**8592**
Number of turtles taken by set type/ Number of sets with turtle takes								**Total**	
School set	37 / 32	18 / 18	26 / 22	69 / 49	27 / 20	4/4	18/15	15/13	**214/173**
Dolphin set	28 / 25	9 / 8	35 / 33	10 / 9	5 / 5	0	0	0	**87/80**
Floating obj. set	89 / 68	122 / 82	117 / 87	112 / 89	87 / 66	97/82	69/58	103/85	**796/617**
Totals	**154 /125**	**149 /108**	**178 /142**	**191 /147**	**120 / 91**	**103/86**	**87/73**	**118/98**	**1097/870**
Number of sea turtles taken (mortality in parentheses) by species[2]								**Average**	
Olive ridley	113(2)	104	132	133(1)	69	69(1)	45(1)	95(1)	**96**
Green turtle	4	8	21	35	28	29	17	11	**19**
Leatherback	3	0	0	2	1	0	0	0	**0.8**
Hawksbill	0	0	1	0	0	2	0	2	**0.6**
Loggerhead	0	1	0	0	3	0	0	2	**0.8**
Unidentified	36	37	25(1)	21	19	3	25	8	**22**
Totals	**156**	**150**	**179**	**191**	**120**	**103**	**87**	**118**	**140**
Condition of sea turtle when released (injury/mortality due to set)								**Average**	
Prev. dead	0	0	2	1	4	2	0	2	**1.4**
Released unharmed	126	137	168	181	115	92	73	110	**127**
Released slightly injured	13	5	7	1	3	6	5	2	**5.3**
Kill accidentally	2	0	1	1	0	1	1	1	**0.9**
Escaped net	11	5	3	6	2	0	7	3	**4.7**
Other/unknown	3	3	0	2	0	4	1	2	**1.9**
Totals	**156**	**150**	**181**	**192**	**124**	**105**	**87**	**120**	**141.1**

[1]First year of sea turtle data collection, did not began until 3/20. Summary reflects cruises from 3/20/90 - 12/30/90, when data was collected. 1629 sets out of 1814 for 1990 were observed for sea turtles.

[2]Mortalities are a subset of total incidental take.

B. Foreign tuna purse seine fishery in the ETP

The international fleet represents the majority of the fishing effort and carrying capacity in the ETP tuna fishery, with most of the total capacity consisting of purse seiners greater than 400 st. These large vessels comprised about 87 percent of the total fishing capacity operating in the ETP in 1996 (IATTC, 1998). An average of 107 foreign vessels with a carrying capacity greater than 400 st fished in the ETP during 1993 to 1997. In addition to these larger vessels, the foreign fleet contains smaller vessels less than 400 st that target tuna in the ETP. From 1993 to 1997, an average of 63 foreign vessels ranging from 45 to 400 st carrying capacity fished in the ETP each year. These smaller vessels fish for tuna year-round off the coast of Central and South America. Currently, Mexico has the largest fleet capacity of tuna purse seine vessels fishing in the ETP, with more than 41 vessels greater than 400 st in 1997. Ecuador, Venezuela, and Vanuatu have 23, 22, and 12 large vessels, respectively. Foreign purse seine fleets use a variety of techniques to fish for tuna in the ETP. Some nations prohibit their vessels from fishing on dolphin, while others promote dolphin fishing because of its efficiency and the higher overall yellowfin tuna yields that might result from fishing solely on dolphin. Foreign fleets are expected to continue fishing in current patterns, with some nations fishing on dolphin, others on floating objects and schools, and others using a mix of strategies. Fishing strategies are not expected to change as a result of the proposed action for several reasons: 1) the entire ETP tuna purse seine fleet is subject to an annual dolphin mortality limit not to exceed 5,000 animals; 2) fleet capacity is currently limited within the IATTC; 3) economics (a new super seiner costs between $15 and $20 million U.S. dollars to construct); and 4) trends since 1976 indicate that the number of large foreign purse seine vessels fishing in the ETP has varied slightly, averaging around 95 vessels (NMFS, 1998a).

Data from observers on both U.S. and foreign tuna purse seine vessels have been gathered collectively by the IATTC since the early 1990s (Tables 8 and 9). The most recent data from the IATTC indicate that an average of 172 sea turtles per year were killed by vessels over 400 st in the entire ETP purse seine fishery (U.S. included) from 1993-97 (IATTC, 1999). IATTC observers do collect data on captures of turtles during sets, however, this data is not currently kept in an accessible manner. Data on numbers of mortal takes are maintained within a searchable database. During this time period, more sea turtles on average were caught and killed in log (floating object) sets (averaged 85 turtles per year) than in school sets (averaged 50 turtles per year) or dolphin sets (averaged 37 turtles per year).

Table 8. Estimated sea turtles mortality by species for the entire ETP tuna purse seine fishery (U.S. and foreign) from 1993-1997[1]

Species/Year	1993	1994	1995	1996	1997
Olive ridley	197	103	94	83	99
Loggerhead	5	10	2	3	7
Green/black	39	8	12	7	19
Leatherback	0	0	0	1	0

Hawksbill	0	2	0	1	0
Unidentified	46	36	32	29	25
TOTAL	287	159	140	124	150

[1] (M. Hall, IATTC, personal communication, 1999)

Table 9. **Estimated sea turtle mortality[1] by set type for the <u>entire</u> ETP purse seine fishery (U.S. and foreign) for 1993-1997[2].**

Year/Set Type	1993	1994	1995	1996	1997
Dolphin set	49	77	30	19	8
School set	124	28	20	28	52
Log set	116	54	90	76	90
Total	289	159	140	123	150

[1]Includes only turtles which were killed or sustained injuries which were judged likely to lead to death.
[2](M. Hall, IATTC, personal communication, 1999)

From 1993 to 1997, more sets were made on dolphins than on schools or floating objects (IATTC, 1999). Comparing turtles caught per 1,000 sets, a per-year average of 5.8 sea turtles were killed in 1,000 sets on dolphins, 9.8 sea turtles were killed in 1,000 sets on schools, and 25.6 sea turtles were killed in 1,000 sets on floating objects (M. Hall, IATTC, personal communication, 1999).

Of the identified species killed during 1993-1997, 83 percent were olive ridleys, 12.3 percent were green turtles, 3.9 percent were loggerhead turtles, and the remaining less than 1 percent were leatherback and hawksbill turtles.

The 1993-1997 data also indicate that 168 turtles killed by the entire tuna purse seine fishery were ‘unidentified’, although the reasons for this were not given. Assuming that these unidentified turtle mortalities occurred in the same proportions as the identified turtle mortalities, these 168 turtles would be 140 olive ridleys, 20 green turtles, 7 loggerhead turtles and one would be either a leatherback or hawksbill.

Summary of the Environmental Baseline

Since sea turtles are wide-ranging species, the status of olive ridley, loggerhead, green, leatherback, and hawksbill sea turtles in the ETP is generally the same within the action area as it is throughout the entire species range. None of the factors described above appear to improve an individual of the species’ ability to replace itself, or improve the survival rates of individuals of the species. The Integration and Synthesis of Effects section of this Opinion provides tabular summaries of estimated past and future capture and mortality rates due to fishing activities in the ETP.

V. Effects of the Proposed Action

In the ESA, "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (§ 3(19)). Incidental take of a listed species is defined as take that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a federal agency or applicant (50 CFR § 402.02). NMFS has determined that "harm" in the definition of "take" in the ESA includes "any an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including, breeding, rearing, migrating, feeding or sheltering (64 FR 60727). "Take" of listed species associated with the proposed action is expected to occur in the form of harassment, harm (injury), or mortality due to being incidentally encircled, captured, or entangled in a purse seine net during fishing operations.

<u>Analysis of Interim Final Rule Components</u>

United States canneries have indicated that they will not buy or import tuna which has been caught by intentionally setting on dolphins. In addition, U.S. purse seine vessels have agreed to not intentionally set on dolphins to catch tuna in the ETP (P. Donley, personal communication, 1999). Therefore, although the interim final rule would allow U.S. vessels to set on dolphins to catch tuna in the ETP, NMFS does not expect U.S. vessels to change their fishing strategies and begin fishing on dolphins to catch tuna -- these vessels are expected to continue to fish on floating objects and schools. Nevertheless, because components (i), (ii), and (iv) of the interim final rule would allow large U.S. purse seiners in the ETP to set on dolphin, NMFS has considered all changes to fishing operations of the U.S. large-vessel tuna purse-seine fleet in the ETP in this biological opinion.

Smaller purse seiners (less than 400 st) are not legally allowed to make intentional marine mammal sets in the ETP. Moreover, smaller seiners are considered incapable of making intentional sets on dolphins because these vessels use shorter nets, are slower, and lack space on board to carry enough speedboats to effectively chase and encircle dolphins. Under the interim final rule, U.S. purse seine fishing vessel of 400 st carrying capacity or less would continue to be prohibited from setting on dolphins in the ETP. NMFS expects that these boats will continue to set on schools of tuna as previously described and will not change as a result of this interim final rule. NMFS also believes that the capture of sea turtles by small vessels in the U.S. fleet is a rare event because these vessels fish primarily on tuna schools, which have a low probability of turtle capture per set. However, since large vessels setting on schools of tuna are anticipated to capture 75 turtles per 1,000 sets with a 5 % mortality, the potential exists for smaller vessels fishing in a similar way to incidentally take turtles. To address this uncertainty, the IATTC may recommend that the small purse seine vessels carry observers for all or part of their fishing trips in the ETP in order to gather more accurate data on bycatch and discards at sea. A workshop for discussing bycatch by ETP tuna purse seine vessels is scheduled for April 2000, in La Jolla, California.

Although some foreign nations have continued to set on dolphins to catch tuna in the ETP (and exported such “embargoed” tuna outside the United States), under the interim final rule, as long as these nations were compliant with the IDCP (component (iii)), they now could export such tuna into the United States. Nevertheless, NMFS does not expect the foreign fleet to increase in size or effort or modify its fishing strategy for several reasons. First, the entire ETP tuna purse seine fleet is subject to an annual dolphin mortality limit (DML) of up to 5,000 animals. As more IDCP-compliant vessels enter the fleet, each vessel's DML would decline. As per-vessel DMLs decline, the chances an individual vessel will exceed its DML increases, and concurrently, the chances the entire nation's aggregate DML would be exceeded increases. Once a nation's aggregate DML is exceeded, that nation must prohibit its vessels from fishing on dolphin that year. Second, the ETP tuna purse seine fleet capacity is currently limited by the IATTC; new vessels entering the fishery would decrease the available capacity allowed for each boat. Third, large vessels are extremely expensive to build (US$ 15-20 million). The economic impacts of these factors on individual fishers seems to decrease the viability of new boats entering the fleet. For these reasons, NMFS does not expect the foreign fleet to increase in size or effort or change its fishing strategy.

Since NMFS’s primary source of information for estimating the incidental take of sea turtles is based on observed rates of turtles captured per set, it is important to emphasize that NMFS has assumed that past levels of effort and numbers of sets per year on floating objects, schools of tuna, and dolphin will continue at levels observed in the past.

The tracking program described in component (v) of the interim final rule would establish a domestic program to accurately document the dolphin-safe condition of tuna as it is fished, processed, and sold to wholesale and retail markets in the United States and throughout the world. This component is not intended to change fishing practices in the ETP tuna purse-seine fleet, only document the condition of tuna caught during normal fishery operations. The tracking and verification program is not expected to affect any listed sea turtle.

<u>Changes in U.S. fleet composition</u>

NMFS does not expect additional large U.S. purse seine vessels to enter the ETP tuna purse seine fishery in the future because of historical trends in vessel participation and the high start-up costs for a new large vessel to enter the fishery. In the late 1980s and early 1990s, with the passage of the South Pacific Regional Tuna Treaty, most U.S. large purse seiners either re-flagged or moved to the richer fishing grounds of the central-western Pacific Ocean. With little incentive to fish in the ETP, NMFS does not expect a future influx of large U.S. purse seine vessels.

NMFS does not expect a significant influx of smaller vessels into the ETP tuna purse seine fishery. The coastal pelagic fishery is a limited entry fishery. Therefore, any small (400 st) purse seine vessels that potentially would enter the ETP tuna fishery would either be a brand-new purse seine vessel or a purse seine vessel that normally targets squid–squid is not a limited entry fishery. Most squid purse seine vessels originate from Washington and generally fish for more profitable salmon in Washington and Alaska in the summertime, not for tuna in the ETP.

Impacts of U.S. large-vessel fleet operations

The proposed action will allow U.S. fishing vessels to participate in the ETP tuna purse seine fishery on equivalent terms with the flag vessels of other IDCP signatory nations. Therefore, large (>400 st carrying capacity) U.S. tuna purse seine vessels would be allowed to set on dolphins to catch tuna in the ETP. Such fishing is not expected to occur, at least initially, because U.S. canneries have stated that they will not buy tuna that has been caught by setting on dolphins. United States purse seine vessels are expected to continue fishing on schools and floating objects at the same approximate levels as in the 1993-97 period. Thus, U.S. vessels would continue to fish on floating objects and schools in which there is capture of sea turtles (just over 234 animals per 1,000 floating object sets, and 75 animals per 1,000 school sets). Therefore, NMFS expects that there would be no change in the current number of sea turtles taken annually by U.S. vessels in the ETP. However, if U.S. purse seine vessels in the ETP shifted from floating object or school fishing to setting on dolphins to capture tuna, the level of sea turtle mortality would decline because the capture rate of sea turtles in dolphin sets (37 sea turtles per 1,000 sets) is much less than in log sets or school sets, and the survival rate would be expected to stay the same. Any decrease in sea turtle mortality as a result of shifting fishery operations is expected to benefit all affected sea turtle species.

As summarized earlier, “take” refers to any capture or entanglement in the net and subsequent release, injury or mortality of a sea turtle. Potential impacts from the U.S. ETP tuna purse seine fishery on sea turtles will generally be related to injury or mortality. Injury or mortality may result from being dropped on deck, excessive net abrasions or from being run through the power block as the net is hauled aboard. The incidental take of sea turtles related to capture or entanglement, whether or not they are injured or killed, may also impact sea turtles. The tendency for turtles to associate with flotsam in the open ocean makes them more likely to be involved with log or FAD sets. Capture means the turtle was within the perimeter of the net when the rings were already hoisted up. A turtle can become entangled in the webbing at any time during the set, including along the outside perimeter. Also, repeated capture of the same animals is likely to have an additive adverse effect, particularly if the fishing vessels are in an area where borderline animals have been resuscitated. Turtles that are recaptured may drown more easily if they have already been debilitated or weakened by the previous capture. Debilitated turtles also may be captured by other fisheries if the vessels are fishing in an area of high turtle density. Presumably, recapture would depend on the condition of the turtle and the intensity of fishing pressure in the area. NMFS has no information on the likelihood of recapture of sea turtles by the ETP tuna purse seine fishery or other fisheries.

Observer data from 1990-97 indicated that sea turtles caught by the U.S. tuna purse seine fleet had a high survival rate. Approximately 90 percent of the sea turtles caught were released unharmed (1002 released unharmed/1104 total captured), 3.8 percent were released slightly injured (42 slightly injured/1104 total), and 0.6 percent were killed accidentally (7 killed/1104 total) (see Table 7). The rest either escaped the net, or were previously dead. “Escapes” were often the result of turtles entangled outside the net and dropping free during the net roll. “Previously dead” recordings were for turtles that were obviously dead before they became entangled, and these were not recorded as “takes.” Overall, approximately 95 percent of captured or entangled sea turtles were released unharmed, or uninjured, or escaped from the net.

No stress studies have been conducted on sea turtles that have been released unharmed after being caught in a purse seine net. Stress and survivability studies have been conducted on the Hawaii longline fishery and the Atlantic shrimp trawl fishery. Sea turtles captured in the Hawaii longline fishery may suffer stress from internal or external hooking injuries and continued submergence. Sea turtles in the Atlantic shrimp trawl fishery are forcibly submerged by the trawls and kept submerged for long periods, often resulting in high mortalities. Contrary to these fisheries, turtles captured by the purse seines may suffer injuries from net entanglement or from being dropped on deck or run through the power block as the net is hauled aboard. The level and types of injuries suffered by turtles in the purse seine fishery, specifically the lack of incidents of forced submergence and eventual drowning, makes direct application of the results of these studies to turtles captured in the purse seine fishery difficult. Thus, NMFS is only able to make assumptions on the condition of turtles that have been released “unharmed” from a purse seine net in the ETP. Although turtles released “unharmed” do not have visible injuries, they may have been stressed from being caught or entangled in a net. This stress may cause an interruption in essential feeding behaviors or migration patterns; however, NMFS believes this effect, if experienced, is likely to be temporary and short-term. For these reasons, NMFS will assume that any turtle released and reported as “unharmed,” or “uninjured”, has not been harmed or harassed by its capture in the net and that latent effects are limited to short-term physiological stress or interruption of normal behavior patterns.

Mortalities of sea turtles as a result of the proposed action may have long-term effects on the affected population. Other than the obvious impact of a loss of an individual turtle, mortalities also result in the loss of the reproductive potential of that turtle. NRC (1990) estimates that the reproductive value of an adult loggerhead is 584 times that of an egg or hatchling, because so few eggs or hatchlings survive to maturity. Sea turtles are long-lived and delay sexual maturity for several decades. Loggerheads and green turtles may reach sexual maturity as early as 22 or 30 years of age, or as late as 30 to 60 years of age, respectively. Females of each species lay approximately 100 eggs per clutch in 2 or 3 clutches every 2 to 4 years. Thus, the death of adult or juvenile females could potentially preclude the production of hundreds of hatchling turtles, though most of these would not survive to sexual maturity. NMFS is not aware of a disproportionate mortality of adult female turtles in the U.S. ETP purse seine fishery. Mortalities of adult or large juvenile males would preclude their contribution to future generations, though it is difficult to quantify this impact given the minimal data on male sea turtles. As described below, current mortalities of sea turtles in the U.S. ETP fishery are low; therefore, lost reproductive potential as a result of accidental sea turtle mortality in the continuing U.S. ETP purse seine fishery is probably minimal.

Because the abundance, distribution, and the migration and foraging patterns vary so significantly between the sea turtle species that may be encountered by purse seiners in the ETP, their vulnerability to the U.S. fleet's fishing operations will also vary. The following sections review the possible impacts of the proposed action on each of the sea turtle species.

Loggerhead Impacts

The incidental take of loggerhead turtles by the U.S. tuna purse seine fleet (large vessels only) in the ETP is rare. This may be due in part because loggerheads are rarely seen in the eastern Pacific. From 1990-97, the U.S. fleet took (i.e. captured or entangled) six loggerheads in 8,592 total sets. None of the loggerheads incidentally taken were killed accidentally, three were released unharmed, and data on the other three are unavailable. Genetic information on loggerheads caught in the Hawaiian longline fishery and in the California drift gillnet fishery indicate that a majority (95 percent, and 100 percent, respectively) of the turtles originated from nesting areas in Japan. In addition, studies of large aggregations of mainly subadult and juvenile loggerheads feeding off the west coast of Baja California have shown these animals to originate from the Japanese nesting stock. Juveniles and subadults prefer pelagic crustaceans and fish to the benthic invertebrates that adult loggerheads prefer. Therefore, the loggerhead turtles caught in tuna purse seines in the ETP are most likely subadults, and they most likely originate from Japan. The most recent information indicates that only 1,000 females nest annually in Japan. An anecdotal report by Bartlett (1989, *in* Wetherall *et al*., 1993), describes an aggregation of more than 100,000 immature loggerheads feeding off the coast of Baja California. Based on past fishery performance (seven vessel fishery, 1992 - present), NMFS anticipates that three loggerhead turtles may be incidentally captured during the U.S. tuna purse-seine fishery annually. Assuming that loggerheads have the same high survival rate (approximately 95 percent) of the aggregate species, it is highly likely that most captured loggerheads would be released unharmed. If 5 percent of the loggerheads captured may be killed or injured by the U.S. tuna purse seine fleet, it is possible that one loggerhead turtle may be killed every 7 years.

Leatherback Impacts

The incidental take of leatherbacks by the U.S. tuna purse seine fleet in the ETP is rare. From 1990-97, the U.S. fleet captured (unknown mortality) six leatherbacks. Of these six, 2 were released unharmed, 1 had slight injuries, and the data on the fate of the other three is currently unavailable. The population dynamics, abundance, and pelagic distribution are even less understood than those of the other sea turtle species, and the impacts of the U.S. purse seine fleet clearly depend on the stock origins of the leatherbacks encountered in the fisheries. Based on past fishery performance (seven vessel fishery, 1992 - present), NMFS estimates that two leatherback turtles may be incidentally entangled by the U.S. fleet each year, and that the possibility of these entangled turtles dying as a result of their entanglement is extremely low. If 5 percent of the leatherbacks captured may be killed or injured by the U.S. tuna purse seine fleet, it is possible that one leatherback turtle may be killed every 10 years.

Green turtle Impacts

Although the incidental take of green turtles is rare in the U.S. purse seine fishery, it was the second most common species taken by the fleet from 1990-97 - a total of 153 were incidentally taken, representing 16 percent of sea turtle species incidentally taken during that time period. Of the green turtles taken, none were reported accidentally killed. Based on past fishery performance (seven vessel fishery, 1992 - present), NMFS estimates that up to 35 green turtles per year could be captured. Assuming that 5 percent of these sea turtles would be killed accidentally or injured (based on the survival rate of turtles caught by the U.S. fleet from 1990-97), NMFS estimates that no more than two green turtles would be killed by the U.S. fleet annually.

Hawksbill Impacts

Only five hawksbills were incidentally captured by the U.S. fleet between 1990 and 1997, and of these, none were killed accidentally. Therefore the incidental take of hawksbills by U.S. tuna purse seiners in the ETP is extremely rare. This is probably due to the fact that hawksbills generally tend to prefer shallow waters (<16 m deep), where coral reefs and other hard substrates serve as habitat for their preferred food, sponges and small crustaceans. Tuna purse seiners tend to fish in deeper waters offshore. Nesting of hawksbills is widespread, although not abundant, and it appears to be declining rapidly over the past few decades due to legal and illegal harvest and expansion of human populations into island territories. Based on past fishery performance (seven vessel fishery, 1992 - present), NMFS estimates that a maximum of two hawksbill turtles may be captured by the U.S. tuna purse seine fleet annually. If 5 percent of the hawksbill turtles captured may be killed or injured by the U.S. tuna purse seine fleet, it is possible that one hawksbill turtle may be killed every 10 years.

Olive Ridley Impacts

Since olive ridleys are the most abundant sea turtle in the Pacific basin, it is not surprising that they are the most commonly caught species in the U.S tuna purse seine fishery. From 1990-97, the U.S. fleet captured 760 olive ridleys, averaging approximately 96 per year. Of these captured olive ridleys, 6 were reported killed accidentally. Olive ridleys live a completely pelagic existence, they are small, they tend to aggregate in large groups, and they often associate with floating objects, which may provide them with food and shelter. These features and migration and foraging patterns make the olive ridley the most vulnerable sea turtle species to purse seine fishing, especially floating object and school sets. From 1990-97, three olive ridleys killed by the U.S. fleet were in floating object sets, and the remaining three were killed or had grave injuries after being caught in school sets. Olive ridleys caught in the Hawaiian longline fishery were genetically sampled and were found to originate from nesting beaches in the eastern Pacific and the southwest or Indo-Pacific. Although most of the nesting populations of olive ridleys are known or thought to be depleted, large aggregations do continue to exist along southern Mexico and central America. Nesting in Malaysia has experienced a rapid decline, however, so if the olive ridleys caught by the U.S. fleet originate from Malaysia, the effects on the sub-population there could be more serious. Based on past fishery performance (seven vessel fishery, 1992 - present), NMFS anticipates that 133 olive ridley turtles could be captured each year in the U.S.

tuna purse seine fishery. Assuming that 5 percent of these sea turtles would be killed accidentally or injured, approximately 7 of these turtles could die each year.

VI. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The fisheries described as occurring within the action area (section IV. Environmental Baseline), including the foreign fleet component of the ETP tuna purse seine fishery, are expected to continue as described into the foreseeable future. NMFS is not aware of any proposed or anticipated changes in these fisheries that would substantially change the effects each fishery has on the sea turtles covered by this opinion. In addition, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g. poaching, habitat degradation) or natural conditions (e.g. over-abundance of land or sea predators, changes in oceanic conditions) that would substantially change the effects that each threat has on the sea turtles covered by this opinion. Therefore, NMFS expects that the levels of incidental take of sea turtles described for each of the fisheries and non-fisheries will continue into the foreseeable future.

VII. Integration and Synthesis

This section provides an integration and synthesis of the information presented in the Status of the Species, Environmental Baseline, Cumulative Effects, and Effects of the Action sections of this Opinion. The intent of the following discussion is to provide a basis for determining the additive effects of continuing the proposed U.S. ETP tuna purse seine fishery on green, loggerhead, leatherback, olive ridley, and hawksbill sea turtles, in light of their present and anticipated future status in the ETP.

The Status of the Species discussion describes how all listed sea turtle populations affected by the proposed action have been adversely affected by human-induced factors such as commercial fisheries, direct harvest of turtles, and modification or degradation of the turtle's terrestrial and aquatic habitat. Effects occurring in terrestrial habitats have generally resulted in the loss of eggs or hatchling turtles, or nesting females, while those occurring in aquatic habitat have caused the mortality of juvenile, subadult and adult sea turtles through entanglement in fishing gear, ingestion of debris or pollution. While the loss of juvenile turtles, including eggs, has likely adversely affected the ability of all sea turtle populations considered in this Opinion to maintain or increase their numbers by limiting the number of individuals that survive to sexual maturity, the loss of adult females has resulted in reductions in future reproductive output.

Species with delayed maturity such as sea turtles are demographically vulnerable to increases in mortality, particularly of juveniles and subadults, those stages with higher reproductive value.

As discussed in the Status of the Species, the age of sexual maturity of most species of sea turtles is currently unknown, although the sexual maturity of loggerhead sea turtles may be as high as 35 years, and green turtles may not reach maturity until 30-60 years. The potential for an egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult sea turtle varies among species, populations, and the degree of threats faced during each life stage. It is reasonable to assume that females killed prior to their first successful nesting will have contributed nothing to the overall maintenance or improvement of the species' status, while females killed after their first successful nesting may have produced some juvenile turtles that survive to sexual maturity. Based on information provided in the Status of the Species, it is currently unknown how past and present mortalities of individual sea turtles due to a variety of natural and human-induced factors have affected the ability of individual sea turtles to replace themselves, thereby maintaining population numbers. Given the continuing declines observed for most populations of listed sea turtle species in the Pacific Ocean, NMFS assumes that it is likely that several individuals of the sea turtle population considered in this Opinion are not currently able to replace themselves.

Although a long-term, qualitative analysis of the anticipated effects to sea turtles due to the proposed implementation of the interim final rule is complicated by a lack of information regarding the age-specific survivorship and age-specific fecundity of each of the sea turtle species considered in this Opinion, certain assumptions can be made using limited information from sea turtles in general and basic concepts of conservation biology. For example, an understanding of loggerhead sea turtle demography has been developed which provides a fundamental understanding of the relative reproductive values of various life history stages (Crouse 1987, 1999; NRC 1990), which can be broadly extended to other sea turtles. As described in the Status of the Species discussion, sea turtles face numerous natural and human-induced factors in both the marine and terrestrial phases of their life cycles. While the most vulnerable stages may be the early ones, the reproductive value of a turtle egg or hatchling is relatively low and the sensitivity of population growth to a loss of an egg or hatchling also is low. This high mortality at early life stages has led to strong evolutionary pressures selecting for a high adult survival of sea turtles and a resulting ability for repeated reproduction. As a result sea turtle populations under normal conditions are better adapted to withstanding losses at early life stages than their subadult and adult phases. Environmental factors which cause injury or mortality to individual juvenile, subadult, or adult sea turtles are more likely to have longer term, adverse effects on sea turtles at a population level than loss of eggs or hatchlings. At a much more basic level, if mortality rates continue to exceed recruitment rates, populations will continue to decline.

Of all the known factors identified in NMFS decision to list sea turtles as threatened or endangered, Status of the Species, and the current Environmental Baseline and anticipated Cumulative Effects described in this Opinion, by far the most significant sources of injury or mortality of large juvenile, subadult, and adult sea turtles are those associated with commercial fishing. Assuming observations of loggerhead demographics apply broadly to all sea turtles, these factors are acting on the life stages with the greatest reproductive value for the survival and recovery of sea turtle populations, large juveniles and subadults. The reproductive value of a mature sea turtle can be assumed to remain high for several years under normal conditions. Based on this, we can conclude that the population growth of sea turtles is most sensitive to changes in the survivorship of large juveniles and subadults, and continued reductions in individuals from these life stages may have longer term effects than losses due to other factors affecting eggs or hatchlings.

Other fishing operations, such as lost fishing gear and marine debris, are also known to injure or kill sea turtles in the ETP, but these factors, and others discussed in the environmental baseline section such as dredging, entrainment in power plant intakes, collisions with boats, natural disease and parasites are not well quantified and affect sea turtles at all life stages. Likewise, although natural predation on turtles in all life stages, parasitism, disease, oceanic regime shifts, inclement weather, beach erosion and accretion, thermal stress, and high tides will continue to exert adverse pressures on sea turtle populations, especially on nesting beaches, the long term effects of these ongoing factors to the future status of sea turtles are uncertain.

To evaluate fully the comparative significance of these different sources of mortality, better information is needed on age at reproductive maturity, age-specific survivorship, age-specific fecundity, and their variances. In addition, data on age structure and sex composition of sea turtles taken incidentally to the U.S. ETP large vessel purse seine fishery and many other fisheries is limited, there is generally little information on survival rate of various age classes of turtles, and the population structure of sea turtles on the fishing grounds is uncertain. Absent this information, NMFS assumes that the status of green, hawksbill, loggerhead, olive ridley and especially leatherback sea turtles in the ETP will continue decline and sources of injury and mortality of sea turtles described in the Environmental Baseline will continue at current levels.

Information is available to allow estimates of past and ongoing levels of capture and release, injury, and mortality of sea of sea turtles in various fisheries described in the Environmental Baseline (Tables 10 -14), and from these, future estimates of capture and mortality can be extrapolated. Based on these estimates, and a general understanding of the demographics of sea turtles, further assumptions can be made regarding both past and future effects of different activities on sea turtles. For example, prior to 1992, leatherback sea turtles were seriously affected by directed harvest on nesting beaches, and incidental capture in both nearshore and high seas driftnets (Eckert 1993; Sarti et al., 1996; Weatherall et al., 1993; Crouse 1999). Looking at these data, it could reasonably be assumed that long-term demographic effects of these losses are still evident in leatherback populations in the ETP, and given current observations of continued declines, a reasonable assumption could also be made that the long term survival of leatherback sea turtle populations in the ETP is uncertain. Additional sources of injury or mortality to this species could have questionable effects on the long-term survival of this species. However, population growth rates are far more sensitive to changes in annual survival rates of juveniles and adults (Crouse et al., 1987) and reliable estimates of other factors such as nesting success are unavailable.

Despite these limitations, NMFS believes a reasonable, qualitative analysis of the proposed continuation of the U.S. tuna fishery in the ETP is possible and that an appropriate horizon to forecast expectations of the fishery's response to the interim final rule is ten years. Given potential changes in the environment and composition of fisheries, extending this analysis beyond ten years would be entirely speculative. Based on the information provided earlier in this Opinion, NMFS has assumed that effects associated with the capture and live, uninjured release of sea turtles is short-term, limited to temporary interruptions of normal feeding and migratory behaviors, and these turtles survive and reproduce at the same rate as unaffected turtles. No long term effects are anticipated from the capture and release of these individuals.

NMFS has also assumed that fishing operations in the U.S. tuna ETP fishery will not change as a result of this interim rule. As described previously, the U.S. large-vessel tuna purse seine fleet in the ETP does not contemplate changing current fishing methods in favor of setting on dolphins, despite the fact that the interim final rule allows this type of fishing. However, should the U.S. large-vessel fleet in the ETP tuna purse seine fishery decide to switch to setting on dolphins, either entirely or in part, NMFS expects the overall effect to sea turtles would be an incremental reduction in the mortality of sea turtles. This is based on information presented in the Effects of the Action section that observations that sets on dolphins result in significantly reduced rates of incidental take of sea turtles (37 captures with a 5.8 mortality rate per 1,000 sets), relative to sets on either logs (234 captures with a 25.6 mortality rate per 1,000 sets) or schools of tuna (75 captures with a 9.8 mortality rate per 1,000 sets). However, since NMFS does not expect U.S. vessels to change current fishing practices, the discussion of effects to sea turtle populations below does not include this possible decrease in effects. On the other hand, NMFS has assumed that incidental take in unobserved fisheries (i.e., vessels less than 400 st) or less studied fisheries is rare.

The following discussion describes the anticipated effects to each of the affected sea turtle species from operations of the ETP U.S. large vessel tuna purse seine fleet, assuming unaltered fishing methods, in conjunction with other fishery and non-fishery sources of impact and mortality described earlier in the environmental baseline and cumulative effects sections.

Loggerhead effects

Table 10 provides a summary of the estimated rates of annual incidental take and mortality of loggerheads by various known fisheries, based on available data. Although the high-seas driftnet fisheries no longer operate, they had relatively high levels of incidental mortality prior to the 1992 moratorium, especially the Taiwanese large-mesh driftnet fleet. The full effects of the driftnet fishery on loggerheads are unknown although they are believed to be significant (Wetherall, *et al*., 1993). In addition, the current and past extent of the effects of the western Pacific and South China Sea longline and bottom trawl fisheries on loggerheads is unknown, although they have been reported captured and killed in these fisheries.

Table 10. **Estimated rates of annual incidental take and mortality for loggerheads based on available or extrapolated data. This table does not contain estimates of take, including mortality, from other sources such as habitat degradation, poaching, or direct harvest.**

Fishery	Incidental Take	Mortality[1]
Japanese squid driftnet	5	1
Japanese large mesh driftnet	600	132
Taiwanese large mesh driftnet	3,489	1,116
California set gillnet	no data	1.3
California drift gillnet	8.7	2
Hawaiian longline	390.5	68.5
Foreign ETP purse seine fleet[2]	52.5	5.25
U.S. ETP purse seine fleet[3]	3	0.15

[1]Mortality is a subset of total incidental take.

[2]Based on 1994-98 data for the entire fleet with the mortality estimates for the U.S. fleet subtracted. Incidental Take is back-calculated from Mortality assuming a 10 percent mortality rate.

[3]Based on 1992-97 data. Expressed as an annual rate of mortality

= pre-12/92

Over the next ten years, NMFS has estimated that 4,520 loggerheads (or 452 per year) may be captured, entangled, or hooked by fisheries other than the ETP U.S. tuna purse seine fleet (large vessels only). This includes approximately 53 loggerheads captured per year by the foreign ETP purse seine fleet, based on an annual mortality rate of 5.25 loggerheads, and assuming a 10 percent mortality rate of these captured loggerheads. Estimated entanglement and mortalities of loggerhead sea turtles may be higher due to unknown captures in other fisheries which are not currently observed. Of the 4,520 loggerheads captured over the next ten years, NMFS estimates that approximately 770 (or 77 per year) may be killed.

In addition, an unknown number of loggerheads may be injured or killed from non-fishery related effects such as direct harvest, vessel collisions, or entanglement or ingestion of debris. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas are also expected to continue. Since quantitative data on the extent of these impacts to loggerhead turtle populations are lacking, a reliable cumulative assessment of these effects is not possible.

Based on information provided in the Effects of the Action section of this Opinion, NMFS has estimated that the proposed continuation of the U.S. large vessel tuna purse seine fleet will capture/entangle 30 loggerhead sea turtles in the ETP over the next ten years, in addition to those estimated to occur in other fisheries. Of these captures, NMFS estimates that one loggerhead sea turtle may be killed every 7 years (1 sea turtle/0.15 chance that a loggerhead will die in any one year). For the purposes of this analysis, NMFS assumes this mortality will be a large juvenile or adult female loggerhead. NMFS believes that the 26-27 loggerhead sea turtles estimated to be captured and released unharmed from the purse seine nets over the next 10 years will survive unimpaired. Population estimates for the entire species are not available. Based on the current status of the loggerhead population in the ETP (reports of aggregations of thousands of juvenile and sub-adult loggerheads off of Baja (Pitman 1990) and their probable source population of approximately 1,000 females in Japan (Bolten *et al*., 1996; Bowen *et al.,* 1995)), the anticipated continuation of current levels of injury and mortality described in the environmental baseline and cumulative effects section of this Opinion, NMFS believes that the anticipated additional mortality of one loggerhead over the next 7 years from activities associated with the proposed continuation of the U.S. tuna fishery in the ETP, would not reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of loggerhead populations in the wild by reducing the numbers, distribution, or reproduction of the species.

<u>Leatherback effects</u>

Table 11 provides a summary of the estimated rates of annual incidental take and mortality of leatherbacks by various known fisheries, based on available data. Although the high-seas driftnet fisheries no longer operate, they evidently had relatively high levels of incidental mortality prior to the 1992 moratorium, especially the Taiwanese large-mesh driftnet fleet. The full effects of the driftnet fishery on leatherbacks are unknown although they are believed to be significant (Wetherall, *et al*., 1993). The western Pacific and South China sea longline and bottom trawl fisheries may also impact leatherbacks, as there are reported sightings of them in the area; however, the current and past extent of these fisheries is unknown. Current information suggests that the incidental take of leatherbacks in the U.S. and foreign ETP tuna purse seine fishery is extremely rare.

Table 11. Estimated rates of annual incidental take and mortality for leatherbacks based on available or extrapolated data. This table does not contain estimates of take, including mortality, from other sources such as habitat degradation, poaching, or direct harvest.

Fishery	Incidental Take	Mortality[1]
Japanese squid driftnet	300	~60
Japanese large mesh driftnet	23	0
Taiwanese large mesh driftnet	411	103
Chilean swordfish driftnet	250[2]	no data
Micronesian longliners	1	0
California set gillnet	no data	2
California drift gillnet	21	13
Hawaiian longline	173	7
Foreign ETP purse seine fleet[3]	1	0.1

U.S. ETP purse seine fleet[4]	2	0.1

[1]Mortality is a subset of total incidental take -

[2]No differentiation between kill and incidental take, one port surveyed in Chile

[3]Based on 1994-98 data for the entire fleet with the mortality estimates for the U.S. fleet subtracted. Incidental Take is back-calculated from Mortality assuming a 10 percent mortality rate.

[4]Based on 1992-97 data

= pre-12/92

Over the next ten years, NMFS has estimated that 4,440 leatherbacks may be captured, entangled, or hooked by fisheries other than the ETP U.S. tuna purse seine fleet (large vessels only). This includes approximately 1 leatherback captured every year by the foreign ETP purse seine fleet, given an annual mortality rate of 0.1 leatherback, and assuming a 10 percent mortality rate of captured leatherback sea turtles. This capture estimate may be larger due to the unknown effects of other fisheries which are currently not observed. Of the 4,440 leatherbacks captured, approximately 200 (or 20 per year) may be killed over the next ten years (possibly as high as 2,700 (270 per year), if all turtles caught by the Chilean driftnet fishery are killed).

In addition, an unknown number of leatherbacks may be injured or killed from non-fishery related effects such as direct harvest, vessel collisions, or ingestion of debris. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas are also expected to continue. Quantitative data on the extent of these effects to leatherback turtle populations are lacking, however, it is reasonable to assume if current levels of mortality are exceeding recruitment, the population will continue to decline and the long-term survival and recovery of this species may be questionable.

This Opinion has estimated that the U.S. large vessel tuna purse seine fleet may capture/entangle an additional 20 leatherbacks in the ETP over the next ten years. Of these 20 captured leatherbacks, one may be killed every 10 years (1 sea turtle/0.10 chance that a leatherback will die in any one year). It is assumed that this individual will be large juvenile or adult female leatherback. NMFS believes that the 19 leatherback sea turtles estimated to be captured and released unharmed from the purse seine nets over the next ten years will survive unimpaired with no long term effects. Spotila *et al.,* (1996) have estimated the world population of leatherbacks at 25,000 to 42,000 individuals. Based on the preceding evaluation of the status of leatherback sea turtles and the anticipated continuation of current levels of injury and mortality described in the environmental baseline and cumulative effects section of this Opinion, NMFS believes the anticipated additional mortality of one leatherback sea turtle over the next 10 years (or 0.00004 percent of the lowest estimated population) associated with the proposed action, would not reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of leatherback populations in the wild by reducing the numbers, distribution, or reproduction of the species.

Green turtle effects

Table 12 provides a summary of the estimated rates of annual incidental take and mortality of green turtles by various known fisheries, based on available data. Although the high-seas driftnet fisheries no longer operate, they may have had relatively high levels of incidental mortality prior to the 1992 moratorium. The western Pacific and South China Sea bottom trawl and longline fisheries capture and kill green turtles; however, the extent of these effects on the population is unknown.

Table 12. Estimated rates of annual incidental take and mortality for green turtles based on available or extrapolated data. This table does not contain estimates of take, including mortality, from other sources such as habitat degradation, poaching, or direct harvest.

Fishery	Incidental Take	Mortality[1]
Japanese large mesh driftnet	124	37
California set gillnet	no data	2.7
Hawaiian longline	28.5	0.5
Foreign ETP purse seine fleet[2]	150	15.0
U.S. ETP purse seine fleet[3]	35	2

[1]Mortality is a subset of total incidental take

[2]Based on 1994-98 data for the entire fleet with the mortality estimates for the U.S. fleet subtracted. Incidental Take is back-calculated from Mortality assuming a 10 percent mortality rate.

[3]Based on 1992-97 data

= pre-12/92

Over the next ten years, NMFS has estimated that 1,785 green turtles (178 per year) may be captured, entangled, or hooked by fisheries other than the ETP U.S. tuna purse seine fleet (large vessels only). This includes the incidental capture of 150 green turtles per year by the foreign ETP purse seine fleet, given an annual mortality of 15 greens, and assuming a 10 percent mortality rate of these captured greens. This estimate could be higher due to unknown capture rates in other fisheries. Of the 1,785 green turtles captured, approximately 180 (or 18 per year) may be killed over the next ten years.

In addition, an unknown number of green turtles may be injured or killed from non-fishery related effects such as disease, direct harvest, egg poaching, vessel collisions, or ingestion of debris. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas are also expected to continue. Quantitative data on the extent of these effects to green turtle populations is lacking.

This Opinion has estimated that the U.S. large vessel tuna purse seine fleet may capture/entangle an additional 350 green turtles in the ETP over the next ten years. Of these 350 captured green turtles, 20 may be killed over the next ten years (2 per year). NMFS believes that the estimated

330 green sea turtles captured and released unharmed from the purse seine nets will survive unimpaired.

Population estimates for the entire species are not available. Nesting colonies of greater than 2,000 females occur in Mexico, Australia, and Malaysia. At the French Frigate Shoals in Hawaii, nesting populations are estimated at 200-700 females (NMFS and USFWS, 1998c). The U.S. ETP purse seine fleet may accidentally kill 20 green turtles (or less than 0.1 percent of just the populations described above) over ten years. NMFS has assumed that all of these individuals are large juvenile or adult female green sea turtles. This is a conservative estimate because the take of green turtles in the fishery is likely not limited to adult females. Based on the preceding evaluation of the status of the species and the anticipated continuation of current levels of injury and mortality described in the environmental baseline and cumulative effects section of this Opinion, NMFS believes the anticipated additional loss of twenty green sea turtles over the next 10 years associated with the proposed action, would not reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of green sea turtle populations in the wild by reducing the numbers, distribution, or reproduction of the species.

Hawksbill effects

The incidental take and mortality of hawksbills by any fishery is extremely rare, as indicated by the data summarized in Table 13. Table 13 provides a summary of the estimated rates of annual incidental take and mortality of hawksbill turtles by various known fisheries, based on available data.

Table 13. Estimated rate of annual incidental take and mortality for hawksbill turtles based on available or extrapolated data. This table does not contain estimates of take, including mortality, from other sources such as habitat degradation, poaching, or direct harvest.

Fishery	Incidental Take	Mortality[1]
Japanese large mesh driftnet	4	4
Micronesian longliners	0.08	0
Micronesian purse seiners	0.15	0.08
Foreign ETP purse seine fleet[2]	5	0.5
U.S. ETP purse seine fleet[3]	2	0.1

[1]Mortality is a subset of total incidental take

[2]Based on 1994-98 data for the entire fleet with the mortality estimates for the U.S. fleet subtracted. Incidental Take is back-calculated from Mortality assuming a 10 percent mortality rate.

[3]Based on 1992-97 data

= pre-12/92

Over the next ten years, NMFS has estimated that 52 hawksbills may be captured, entangled, or hooked by fisheries other than the ETP U.S. tuna purse seine fleet (large vessels only). This includes the estimated annual capture of 5 hawksbills by the foreign ETP purse seine fleet, given an annual mortality of 0.5 hawksbills, and assuming a 10 percent mortality rate of these captured hawksbills. Of the 52 hawksbills captured, approximately 6 may be killed over the next ten years.

In addition, an unknown number of hawksbills may be injured or killed from non-fishery related effects, such as direct harvest for tortoise shell trade. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas are also expected to continue. Quantitative data on the extent of these effects to hawksbill turtle populations is lacking.

This Opinion has estimated that the U.S. large vessel tuna purse seine fleet may capture/entangle an additional 20 hawksbills in the ETP over the next ten years. Of these 20 captured hawksbills, one may be killed every 10 years (1 sea turtle/0.1 chance that a hawksbill will die in any one year). NMFS assumes that this mortality will be a large juvenile or adult female hawksbill. In the event that 20 hawksbill sea turtles are captured in a U.S. purse seine net over the next ten years, NMFS expects that they would be released unharmed and survive unimpaired. Population estimates for the entire species are not available, however anecdotal reports indicate that the population is currently well below historical levels. Hawksbill turtles have never been killed in the seven years of observer data on the U.S. ETP purse seine fleet (see Table 7) suggesting that future mortalities are unlikely. Based on the preceding evaluation of the status of the species and the anticipated continuation of adverse effects described in the environmental baseline and cumulative effects section of this Opinion, NMFS believes the anticipated additional loss of one hawksbill sea turtle over the next 10 years associated with the proposed action, would not reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of hawksbill sea turtle populations in the wild by reducing the numbers, distribution, or reproduction of the species.

Olive ridley effects

Table 14 provides a summary of the estimated rates of annual incidental take and mortality of olive ridley turtles by various known fisheries, based on available data. The South China Sea and western Pacific longliners and bottom trawlers may incidentally take olive ridleys; however, the extent of the take is unknown.

Table 14. Estimated rates of annual incidental take and mortality for olive ridleys based on available or extrapolated data. This table does not contain estimates of take, including mortality, from other sources such as habitat degradation, poaching, or direct harvest.

Fishery	Incidental Take	Mortality[1]
Micronesian longliners	0.23	0.08
Micronesian purse seiners	0.15	0.08
Hawaiian longliners	107.8	27.5

Foreign ETP purse seine fleet[2]	1,082	108.2
U.S. ETP purse seine fleet[3]	133	7

[1]Mortality is a subset of total incidental take

[2]Based on 1994-98 data for the entire fleet with the mortality estimates for the U.S. fleet subtracted. Incidental Take is back-calculated from Mortality assuming a 10 percent mortality rate.

[3]Based on 1992-97 data

Over ten years, NMFS has estimated that 11,190 olive ridleys (or 1,190 per year) may be captured, entangled, or hooked by fisheries other than the ETP U.S. tuna purse seine fleet (large vessels only). This includes the annual capture of 1,082 olive ridleys by the foreign ETP purse seine fleet, given 108 mortalities of olive ridleys, and assuming a 10 percent mortality rate of captured olive ridleys. Of the11,190 olive ridleys captured, approximately 1,360 (or 136 per year) may be killed.

In addition, an unknown number of olive ridleys may be injured or killed from non-fishery related effects, such as direct harvest or ingestion of debris. Adverse effects to sea turtle habitat, including loss of nesting sites or degradation of nesting or foraging areas are also expected to continue. Quantitative data on the extent of these effects to olive ridley turtle populations is lacking.

The olive ridley turtle is the turtle most likely to interact with the U.S. tuna purse seine fishery, based on their abundance, distribution, and habits. This Opinion has estimated that the U.S. large vessel tuna purse seine fleet may capture/entangle an additional 1,330 olive ridleys in the ETP over the next ten years. Of these captures, 70 olive ridley sea turtles may be killed over 10 years (7 per year). For the purposes of this analysis, NMFS assumes this mortality will be female olive ridley. NMFS believes the capture and release of most olive ridley sea turtles from the purse seine nets over the next ten years will not result in harm and will survive unimpaired.

Populations of nesting olive ridley turtles reported by Eckert (1993) were in excess of 675,000 females. The mortality of olive ridley turtles incidental to the U.S. large vessel purse seine fleet in the ETP is estimated to be 7 olive ridley turtles per year, about 0.001 percent of the population. This is a conservative estimate because the take of the olive ridley turtles is located in an area where adult male and juvenile turtles of both sexes are found in addition to adult females which would make the population from which the turtles are being taken even larger. NMFS has assumed that all of these mortalities are of large juvenile or adult olive ridleys. Based on the preceding evaluation of the status of olive ridley sea turtles and the anticipated continuation of current levels of injury and mortality described in the environmental baseline and cumulative effects section of this Opinion, NMFS believes the anticipated additional loss of seven olive ridley sea turtles over the next 10 years associated with the proposed action, would not reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of olive ridley sea turtle populations in the wild by reducing the numbers, distribution, or reproduction of the species.

VIII. Conclusion

After reviewing the available scientific and commercial data, current status of listed sea turtles, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the NMFS' biological opinion that the proposed interim final rule to continue authorization of the U.S. tuna purse seine fishery in the eastern tropical Pacific Ocean under the Marine Mammal Protection Act, as revised by the International Dolphin Conservation Program Act and the operations of the U.S. large-vessel tuna purse seine fishery in the ETP is not likely to jeopardize the continued existence of loggerhead, leatherback, green, hawksbill, and olive ridley sea turtles. No critical habitat has been designated for these species; therefore, none will be affected.

IX. Incidental Take Statement

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. "Harm" is defined in the ESA as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including, breeding, rearing, migrating, feeding or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The reasonable and prudent measures described below are non-discretionary, and must be undertaken so that they become binding conditions of any permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS (1) fails to assume and implement the terms and conditions or (2) fails to require any permittees to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse.

Section 7(b)(4) of the Endangered Species Act (ESA) requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such effects. Only incidental take resulting from the agency action and any specified reasonable and prudent measures identified in the incidental take statement and that comply with the terms and conditions are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

A marine mammal species or population stock which is listed as threatened or endangered under the ESA is, by definition, also considered depleted under the MMPA. The ESA allows takings of threatened and endangered marine mammals only if authorized by section 101(a)(5) of the MMPA. No listed marine mammals are anticipated to be incidentally taken in this fishery.

Amount or Extent of Take

NMFS anticipates that the following sea turtle species will be taken annually by the U.S. tuna purse seiners in the ETP (large vessels only):

Species	Harassment/Capture	Mortality (a subset of capture)
Loggerhead	3	1 every 7 years
Leatherback	2	1 every 10 years
Green turtle	35	2 every 10 years
Hawksbill	2	1 every 10 years
Olive ridley	133	7 every 10 years

Effect of Take

In the accompanying biological opinion, NMFS determined that these levels of anticipated take are not likely to result in jeopardy to green, hawksbill, leatherback, loggerhead, or olive ridley turtles or result in any adverse modification of critical habitat.

NMFS believes the following reasonable and prudent measures, as implemented by the terms and conditions, are necessary and appropriate to minimize effects to sea turtles. The measures described below are non-discretionary, and must be undertaken by NMFS for the exemption in section 7(o)(2) to apply. If NMFS fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. Thus, the following reasonable and prudent measures must be implemented to allow activities by U.S. tuna purse seine vessels greater than 400 short tons (362.8 metric tons) authorized under the IDCPA to continue.

Reasonable and Prudent Measures

1. ETP U.S. tuna purse seine vessel operators shall be educated on sea turtle biology and on methods that will reduce injury or mortality during fishing operations.

2. Captured sea turtles shall be released alive and uninjured from the net in a manner that minimizes the likelihood of further gear entanglement or entrapment.

3. NMFS shall collaborate with the IATTC under the Agreement of the International Dolphin Conservation Program to collect data on capture, injury and mortality of sea turtles in addition to life history information.

6. Mortalities shall be disposed of at sea unless an observer requests retention of the carcass for sea turtle research.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, NMFS must comply or ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure Number 1.

    1A. NMFS will incorporate into the training for U.S. operator permit holders a module on sea turtle resuscitation requirements, as outlined in 50 CFR §223.206(d)(1).

    1B. NMFS will make this module available for the IATTC program, which will include training on sea turtle biology and ways to avoid and minimize sea turtle effects, including resuscitation requirements.

2. The following terms and conditions implement reasonable and prudent measure number 2.

    2A. Turtles must be removed from the net prior to transferring catch from the net to the vessel.

    2B. Turtles must be untangled as quickly and carefully as possible to avoid injury or mortality. The sea turtles must not be dropped on to the deck or run through the power block.

    2C. Turtles must be released over the corkline of the purse seine net by a speedboat driver, swimmer, or raft operator, if possible. Turtles should not be lifted out of the water by a purse seine net that is being rolled aboard a vessel.

3. The following terms and conditions implement reasonable and prudent measure number 3.

    3A. NMFS shall request that the IATTC provide sea turtle data collected aboard U.S. tuna purse seine vessels greater than 400 st to NMFS on a quarterly and annual basis. The report shall include at a minimum the incidental capture, injury, and mortality of sea turtles by species, type of set in which each interaction occurred, and life history information. Photographs should be taken whenever possible.

3B. NMFS shall coordinate with the IATTC bycatch reduction program to collect life history information on sea turtles, such as species identification, measurements, condition, skin biopsy samples, the presence or absence of tags, and the application of flipper tags if none are present.

3C. IATTC collected data shall be submitted to NMFS on an annual basis. NMFS shall evaluate observer data and other available information to determine whether estimated annual incidental injuries or mortalities of sea turtles has exceeded allowable removal levels. The report will be sent to the Sea Turtle Coordinator in Silver Spring, Maryland.

4. The following term and condition implements reasonable and prudent measure number 4.

4A. Dead sea turtles may not be consumed, sold, landed, offloaded, transhipped or kept below deck, but must be returned to the ocean after identification unless the observer requests the turtle to be kept for further study.

X. Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information.

The tuna purse seine fishery observer programs being implemented by foreign countries and the IATTC present a unique opportunity to document foreign take and increase the amount of information collected on the pelagic distribution of sea turtles. Because of the scarcity and value of this information, it is recommended that NMFS use its authority under section 8 of the ESA to encourage the collection of data on sea turtles in the foreign observer programs.

The following conservation recommendations are provided pursuant to section 7(a)(1) of the ESA for developing management policies and regulations, and to encourage multilateral research efforts which would help in reducing adverse effects to listed species in the ETP.

1. Collaborate with the IATTC to develop programs to minimize the incidental take of sea turtles, which may include area or seasonal closures, gear or fishing modification requirements, or prohibition of sets if sea turtles are present within the area of encirclement.

2. Collaborate with the IATTC to use opportunistic research to analyze sea turtle stock structure and evaluate trends and effects of purse seine fishing operations on sea turtles, including collecting skin biopsies, applying flipper tags, and attaching satellite transmitters.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS - Office of Protected Resources requests notification of the implementation of any conservation recommendations.

XI. Reinitiation Notice

This concludes formal consultation on the action outlined above. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the Marine Mammal Division, Office of Protected Resources, NMFS, should immediately request initiation of formal consultation.

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Appendix 1.

FACT SHEET
Time line of Tuna/Dolphin Interaction

1950's Fishermen discovered the as yet unexplained association between schools of large yellowfin tuna and schools of dolphin. As a result, tuna fishermen in the Eastern Tropical Pacific (ETP) began to use this association to locate yellowfin tuna.

1960's Purse seine technology replaces pole and line fishing as a predominate method of harvesting tuna. Fishers begin setting nets around dolphins to harvest tuna swimming below.

1970's The ETP fishery was dominated by U.S. vessels and annual mortality was listed at over 350,000. With enactment of the Marine Mammal Protection Act (MMPA), incidental mortality from fishing by the U.S. domestic fleet began to decline, participation in the fishery by foreign vessels began to increase, and by the mid-1980's, foreign fleets dominated the fishery.

1972 Congress ratified the MMPA in large part in response to public reaction to the high levels of dolphin mortality caused by the tuna fishery in the ETP.

1984 To address concerns regarding increased mortality by foreign vessels, Congress amended the MMPA to tighten the importation requirements for tunas harvested by foreign tuna vessels in the ETP.

1986 Statistics showed dolphin mortality from foreign fishing at over 110,000 for the year, while U.S. mortality was under 21,000.

1988 Congress again amended the MMPA, imposing additional requirements on both U.S. fishermen and imports of foreign tuna.

1990 The total dolphin mortality from foreign fishing was over 47,000, while U.S. mortality was around 5,000. Congress enacted the **Dolphin Protection Consumer Information Act (DPCIA)**, which established standards for tuna labeled as dolphin-safe. The Act did not actually require dolphin-safe labeling, but U.S. tuna canners voluntarily purchased tuna only from vessels where no dolphins were intentionally encircled during the entire fishing trip.

1990's Foreign participation in the ETP fishery continued to increase, and mortality was managed through the voluntary International Dolphin Conservation Program under the auspices of the Inter-American Tropical Tuna Commission (IATTC). The U.S. fleet's participation in the ETP tuna fishery declined to less than 10 vessels due to other economic opportunities in the Western Pacific and MMPA prohibitions in the ETP.

1992 The total dolphin mortality from foreign fishing was approximately 15,100, while U.S. mortality totaled 431. The **International Dolphin Conservation Act (IDCA)** was passed to encourage an international moratorium on the practice of harvesting tuna through the use of purse seine nets deployed on or to encircle dolphins or other marine mammals. The IDCA also established U.S. mortality limits and required that the number of dolphins killed decrease from one year to the next.

The United States and the governments of Belize, Colombia, Costa Rica, Ecuador, France, Honduras, Mexico, Panama, and Spain, whose vessels fish for tuna in the ETP, signed the **La Jolla Agreement** at the annual meeting of the IATTC, in the fall of 1992. The Agreement placed voluntary limits on the maximum number of dolphins that could be incidentally killed annually in the fishery. The participants also agreed to lower the maximum each year over seven years, with a goal of eliminating mortality in the fishery.

1993 The United States fleet was successful in reducing dolphin mortality to an estimated 115.

1994 The IDCA prohibited U.S. citizens from intentionally encircling marine mammals and made it unlawful for any person to sell tuna that wasn't dolphin-safe in the United States after June 1, 1994.

1995 The U.S. and other ETP tuna fishing nations (Belize, Colombia, Costa Rica, Ecuador, France, Honduras, Mexico, Panama and Spain) met again and negotiated the **Panama Declaration**. The Panama Declaration established conservative annual dolphin mortality limits for each species or stock, and represented an important step toward reducing bycatch in commercial fisheries using sound ecosystem management.

Because the multi-nation yellowfin tuna fleet fishes in international waters, a binding international agreement is key to successfully protecting dolphins. The signing nations agreed to a binding international agreement for the continued protection of dolphin and the entire ETP ecosystem, providing the U.S. amended import requirements of the MMPA for those countries participating in the international dolphin conservation program in the ETP.

The signatory nations expected that, if they reduced their dolphin mortality, the U.S. would amend its laws so that participation in the International Dolphin Conservation Program (IDCP) would satisfy comparability requirements of U.S.

law and result in the lifting of embargoes on yellowfin tuna and yellowfin tuna products.

1997 In response to the Panama Declaration, Congress passed the **International Dolphin Conservation Program Act (IDCPA)** to implement the IDCP. The IDCPA primarily amends provisions in the MMPA dealing with yellowfin tuna in the ETP fishery. Key provisions of the IDCPA became effective in March 1999.

1998 The countries participating in the IDCP successfully negotiated the international agreement, which is a legally binding instrument for dolphin conservation and ecosystem management in the ETP. This agreement would become effective when four nations had ratified.

1999 The international **Agreement on the IDCP** became effective on February 15, 1999, when the fourth country ratified. The United States, Panama, Ecuador, and Mexico are the countries that have ratified, to date. On March 3, 1999, the Secretary of State provided the required certification to Congress that the international agreement on the IDCP was in force. Key provisions of the 1997 IDCPA became effective on this date.

Through the International Dolphin Conservation Program, dolphin deaths have been reduced to below the required 5,000 cap annually since 1993. In 1998, dolphin deaths were reported to be less than 2,000.